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# Medical School for Everyone: Grand Rounds Cases

Course Guidebook

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# Table of Contents

---

## INTRODUCTION

Professor Biography .....	i
Course Scope .....	1

## LECTURE GUIDES

### LECTURE 1

I Never Feel Good .....	3
-------------------------	---

### LECTURE 2

A Persistent Fever .....	10
--------------------------	----

### LECTURE 3

Puzzling Pain .....	18
---------------------	----

### LECTURE 4

Just Look at Me .....	25
-----------------------	----

### LECTURE 5

Headaches in Wonderland .....	32
-------------------------------	----

### LECTURE 6

The Tennis Player .....	40
-------------------------	----

### LECTURE 7

Sudden Collapse .....	47
-----------------------	----

### LECTURE 8

School Failure .....	54
----------------------	----

### LECTURE 9

Dizzy Attacks .....	61
---------------------	----

### LECTURE 10

Weight Loss .....	69
-------------------	----

## Table of Contents

---

<b>LECTURE 11</b>	
I Can't Walk .....	76
<b>LECTURE 12</b>	
Learning from Failure .....	83
<b>LECTURE 13</b>	
The Children Who Come and Go .....	90
<b>LECTURE 14</b>	
Guardians' Day .....	97
<b>LECTURE 15</b>	
Dickens's Diagnosis .....	104
<b>LECTURE 16</b>	
Shaking Sammi .....	112
<b>LECTURE 17</b>	
Hickam's Dictum .....	119
<b>LECTURE 18</b>	
Forgetting Jerusalem .....	127
<b>LECTURE 19</b>	
Sherlock's Investigation .....	134
<b>LECTURE 20</b>	
The Boy Who Doesn't Speak .....	141
<b>LECTURE 21</b>	
Antarctic Adventure .....	148
<b>LECTURE 22</b>	
A Sunday Drive .....	154
<b>LECTURE 23</b>	
Cough, Cough, Cough .....	161

## Table of Contents

---

### LECTURE 24

A Confused Father.....	168
------------------------	-----

### SUPPLEMENTAL MATERIAL

Glossary .....	176
Bibliography.....	187

## Disclaimer

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This series of lectures is intended to increase your understanding of how doctors diagnose and treat diseases and how you can improve your own health by being an active and informed patient. However, these lectures are not designed for use as medical references to diagnose, treat, or prevent medical illnesses or trauma, and neither The Teaching Company nor the lecturer is responsible for your use of this educational material or its consequences. Furthermore, participating in this course does not create a doctor-patient relationship. The information contained in these lectures is neither intended to dictate what constitutes reasonable, appropriate, or best care for any given health issue and does not take into account the unique circumstances that define the health issues of the patient. If you have questions about the diagnosis, treatment, or prevention of a medical condition or illness, you should consult your personal physician. The opinions and positions provided in these lectures reflect the opinions and positions of the relevant lecturer and do not necessarily reflect the opinions or positions of The Teaching Company or its affiliates.

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# Medical School for Everyone: Grand Rounds Cases

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## Scope:

We're all fascinated by medical knowledge. From popular television shows to our own visits to the doctor to reports of medical breakthroughs, the culture of medical knowledge has become commonplace in our everyday world. Understanding medicine isn't just enlightening—it can improve your own health and help you cultivate a more beneficial relationship with your doctors.

This course offers a miniature medical school curriculum for nondoctors, structured into a “grand rounds” format similar to how medical students and experienced physicians are taught at hospitals and universities. Each lecture concentrates on a single clinical case. A real patient will be presented, from the initial complaint through the diagnostic process to the treatment decisions, discussing the details of each step. You will follow along as each diagnostic clue is uncovered, with the goal of taking the next best step toward helping the patient. Every lecture is, in a way, a medical mystery—and by the end of each lecture, you will not only understand more about the diagnosis, but also gain insight into how doctors work and think. You will get an insider's view of the art of medical decision making that's rarely revealed to patients.

Topics covered include an overview of many common diseases, including their symptoms and evaluation and treatment; the diagnostic tools of the physician, including the medical history and physical exam along with lab tests, radiology, and other modalities used to diagnose and treat disease; and how patients can best help their own doctors get the information they need. Along the way, you will pick up diagnostic pearls about disease, along with information that is typically only known to medical professionals: their lingo, their style of thinking, and how they go about evaluating patients.

The case histories cover a wide range of patient ages and concerns. You will meet a young man with a chronic fever and a woman with abdominal pain. There's a preteen with a mysterious rash, a woman with dizzy spells, and a

woman with an itchy rash that keeps coming back. You will meet patients who are fatigued and patients who are coughing; patients with chest pain and trouble talking; patients with blurry vision; and a surgeon who had to diagnose and treat himself. Some problems may seem simple at first; some unfold quickly into catastrophe. Some illustrate that there's always hope, and others reveal the limits of what modern medicine can and cannot do. What brings these cases together is a common thread: that medical doctors and patients alike can learn from patient experiences. In fact, doctors' best teachers are their patients.

Patients—and medical professionals, and those considering or pursuing a career in medicine—will enjoy solving the mysteries in each case and learning solid medical information about diagnosis and treatment. But the lasting lessons of this course will be the ones best remembered: how to communicate with physicians, how to help coordinate care when seeing multiple specialists, and how to get the most out of every medical encounter. There are plenty of immediately practical lessons, too: what to do when someone nearby collapses and what kinds of symptoms warrant immediate evaluation. You will also learn about how to talk with people facing serious illnesses—how to share bad news and how to help steer people toward wellness and recovery.

This course reveals how doctors think and how, as a patient, you can improve your own medical experiences through a better understanding of their education and training. By the end of the course, you will not just understand the field of medicine better, but you will also become a better—and healthier—patient. ■

# I Never Feel Good

## Lecture 1

In this course, you'll be exposed to a wide variety of symptoms and diseases, and you'll get a good appreciation for how the body works in health and disease. More importantly, though, by the end of this course, you'll have a much better understanding of how doctors think. By learning this, you will also learn how to be a better patient yourself. Understanding what doctors do—and how and why they do it—will make you a better patient and improve your health.

### From Chief Complaint to Diagnosis

- Imagine that you are working in an **internal medicine** clinic. A 55-year-old woman comes to the clinic with a **chief complaint** of “I never feel good.” A patient's chief complaint is a quote, in the patient's own words, of what his or her main concern is. Why did this person come to see the doctor? It's a very important bit of information, because it focuses the evaluation on what the patient is worried about.
- Sometimes chief complaints don't end up being the main thing that the doctor is worried about and don't directly point to the final diagnosis. But the chief complaint is still something crucial to know when you're getting started.
- In this case, the chief complaint is vague: “I never feel good.” It doesn't really help us narrow down anything, but it does tell us that the patient is really suffering and always feels bad in some way—and maybe has felt bad for a long time.
- After the chief complaint, we take a **history of present illness (HPI)**, which is the patient's story of what's going on, when it started, and what sort of factors influence the symptoms. When we take an HPI, it's important to let the patient do most of the talking. We'll give a bit of a lead or push now and then, with questions to

clarify the story, but this is the time for the patient to tell us what's going on—not the other way around.

- The 55-year-old woman presented a constellation of symptoms, with a history of several seemingly unrelated problems. She had broken a bone and was noted to be deficient in vitamin D; she was also **anemic**, or deficient in iron. She had very low energy. She had a number of different gastrointestinal (GI) complaints spanning several years, some of which seemed to come and go, perhaps at times related to the ingestion of milk.
- The history, our most important diagnostic tool, is followed by a physical exam—to clarify our suspicions and to drive some considerations higher or lower on our list of possibilities.
- After the physical exam, it's time to see if we can make a list of possible diagnoses and then narrow and refine the list based on all of the information we have. When there are many symptoms, as in this case, it may not be possible to fit all of them into one diagnosis, and that's okay. After all, not everyone with disease X has every single symptom that's typical of disease X, and sometimes people with disease X also have a little bit of disease Y.
- To confirm a diagnosis from a list, or to strike off other diagnoses as being not possible, the next step in our evaluation is to order tests. These can include blood work, X-rays, or other sorts of investigations. Labs and X-rays aren't done to fish around and find a diagnosis, but to confirm or refute what we already suspect. That is how doctors think.
- For this patient, her gallbladder ultrasound came back normal, and a chest X-ray was normal, including normal heart size. An electrocardiogram was normal, further confirming that there was no heart disease. Blood tests revealed normal thyroid functioning, low vitamin D levels, and mild anemia. In addition, there was no evidence of ongoing **inflammation** or infection.

- A test confirmed the diagnosis that best fits what we know so far: A blood test was **positive** for **antibodies** seen in celiac disease. The diagnosis of celiac was then confirmed by a gut wall biopsy.
- The key to making the diagnosis is to get all of the information together and to think broadly about what could account for everything. Listening to the patient tell her story is the source of our best clues.

## Celiac Disease

- Celiac disease is a chronic disorder that causes malabsorption of nutrients from the gut, leading to a myriad of symptoms that can include fatigue, anemia, and almost any GI symptom. In celiac disease, malabsorption of nutrients can also affect the bones—decreased absorption of dietary Vitamin D, phosphorus, and calcium can cause decreased bone density.
- With celiac disease, the lining of the gut—the small, fingerlike projections where absorption of food nutrients occurs—is damaged, and the net effect is that nutrients are not absorbed across the gut wall into the blood for use by the body.
- The **primary** symptoms of celiac disease are caused by inadequate nutrient availability and also by the GI effects of having, essentially, food staying in the gut instead of moving into your body. This includes diarrhea, bloating, and abdominal pain.
- Sometimes, constipation can be more of a problem than diarrhea, or—as in the case of the 55-year-old patient—there can be periods of time when these seemingly opposite symptoms go back and forth. Many celiac symptoms also occur outside of the gut.
- Celiac disease was known to the ancient Greeks, who referred to a condition called *koiliakos*, meaning “suffering of the bowels.” A patient case written in the second century described a man with stomach pain who was underweight, pale, weak, and incapable of working—which is still a pretty good description of a severe case in

modern times. The Greek term was translated to the term “celiac” in 1856.

- Around that time, it was recognized that this was a disease that could be managed by diet. In 1954, Dutch pediatrician Willem Dicke linked the disease to the ingestion of wheat protein. It’s speculated that his experience seeing patients improve during the famine of 1944, when wheat was scarce, may have helped him recognize the critical role of wheat in this illness.
- Though the symptoms of celiac disease are varied and affect many organ systems, it only has one cause: ingesting certain proteins found in wheat, barley, and rye. These are natural proteins from a family called gluten proteins. Celiac disease is sometimes called “gluten enteropathy” or “celiac sprue.”
- When gluten-containing foods are eaten by people with celiac disease, these proteins are modified or processed so that they



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**People with celiac disease cannot tolerate gluten, which is a substance that is found in wheat and flour.**

trigger a cross reaction with gut tissue. Basically, the body's own immune system is tricked into attacking healthy cells in the gut (and probably elsewhere, too).

- Celiac disease is in a sense an autoimmune disease—the body attacks itself—but it's an autoimmune disease that has specific and avoidable trigger. It's the gluten proteins that trigger the reaction, and once gluten is no longer part of the diet, the disease itself can almost always be reversed.

### **Treatment and Diagnosis of Celiac Disease**

- The treatment of celiac disease is, simply enough, a gluten-free diet. However, because wheat-based products are very common in a typical Western diet, a gluten-free diet might not be so simple in practice. Though wheat is the main food to avoid, people with celiac should also not eat barley or rye, and it's often suggested that oat products be avoided, too, because typically harvested oats are often contaminated with wheat grains that presumably blow across the crops.
- At this time, there are no medications to prevent or treat the autoimmune damage that occurs when wheat is ingested, and people with celiac need to avoid eating gluten-containing products for the rest of their lives. Avoiding wheat not only helps relieve the immediate symptoms of celiac disease but also reduces the risk of long-term complications of untreated celiac disease, including osteoporosis and an increased risk of cancer.
- For many years, the only way to diagnose celiac disease was by small intestinal biopsy. Dr. Dicke, who made the link with wheat after World War II, also first described the “villous atrophy” characteristic of celiac disease when biopsies are examined under the microscope. Biopsies are still used to definitively diagnose celiac and to monitor patient's progress.
- However, the availability of reliable, relatively inexpensive blood tests to diagnose celiac has changed our approach to this disease.

In the past, only people with persistent and severe symptoms would undergo the procedure necessary to get the biopsies, so celiac was viewed as a disease that was relatively uncommon and always presented with severe gut symptoms.

- The availability of these blood tests has made it easy to test children and adults, and it's become clear that many (if not most) celiac patients have mild symptoms. There are probably many people who have no symptoms whatsoever, though they may be at risk for long-term complications.
- Though current, state-of-the-art blood tests have very good correlation with biopsies, older tests were not as reliable. Patients need to be careful that their physicians are ordering the best tests, and they need to beware that some providers may give a misleading diagnosis based on the wrong tests.
- There are also **genetic** tests available, but it's important that patients understand what these mean. Almost all patients with celiac disease have one of two genetic markers that can be demonstrated in blood or mouth swab samples. If you don't have either of these markers, your lifetime risk of celiac is zero, or at least very close to zero. However, many people do have these markers and do not go on to develop celiac disease. These genetic tests are not affected by a patient's diet.
- While there are no medical downsides to a gluten-free diet, it can be difficult to maintain this diet, as required, for the rest of someone's life. That's why we usually confirm positive celiac antibody tests by biopsy. This may be especially important in children, who tend to be picky eaters and may not take well to a gluten-free diet.

### Important Terms

**anemia:** Low red blood cell count.

**antibodies:** Serum immunoglobulins that are part of the immune system.



**chief complaint** (often abbreviated “CC”; “chief concern” is also used): A traditional part of a medical encounter that is typically recorded in the patient’s own words, expressing the main reason that the patient sought care.

**genetic:** Relating to the genes, or the sequences of DNA encoded in cells that direct their functioning.

**history of present illness (HPI):** A chronologic account of a patient’s symptoms.

**inflammation:** A physiologic reaction to infection or stress that can include redness, swelling, pain, and warmth.

**internal medicine:** A medical specialty that concentrates on the diagnosis and management of nonsurgical problems in adults.

**positive:** In medical lingo, “positive” is used to denote a finding that is present. It does not imply whether this finding is good or bad.

**primary:** A problem or finding that isn’t caused by something else. For example, a primary headache isn’t caused by some other medical condition.

### Suggested Reading

Green and Jones, *Celiac Disease*.

Groopman, *How Doctors Think*.

### Questions to Consider

1. Other than lack of sleep, what could make a person feel fatigued?
2. In a medical encounter, should the doctor or the patient do most of the talking? Why?

# A Persistent Fever

## Lecture 2

In this lecture, you will learn about some of the basic tools of medical diagnosis—the history, the physical, some of the common tests, and X-rays. As a doctor, you'll see that your most important tools are your senses and your brain—listening to your patient, observing, and thinking about data you've collected. Listening can not only help you glean the clues you need, but can also help develop a trusting, two-way relationship with your patient.

### Prolonged Fever

- Imagine that you are in an outpatient clinic—general internal medicine. The patient is a 33-year-old man with a chief complaint of “I can’t get rid of this **fever**.” He had been in excellent health until two months ago. Since then, he has run fevers almost every day, usually in the range of 101 to 102 degrees Fahrenheit. He has also developed a cough that is getting increasingly worse and uncomfortable ulcers or sores in his mouth.
- This is his history of present illness (HPI). The next part of a standard medical history is called a **review of systems (ROS)**. In contrast to the HPI, the ROS is a series of questions driven by the doctor. It’s usually organized by organ system.
- A previously healthy man has had a prolonged fever, plus coughing and mouth sores, GI problems, rashes, fatigue, weight loss, achiness—it seems like just about everything is going wrong with this patient.
- Almost all fevers are caused by one of four broad categories of illness: infection, cancer, autoimmune disease, and miscellaneous. Of these, infections are by far the most common, especially for relatively brief fevers. But the longer the fever persists, the less likely it’s going to be an infection—at least not a straightforward infection.



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If you think you have a fever, a good way to measure your body temperature is by using a thermometer.

- A physical exam confirms that the patient is quite ill. He has what sounds like pneumonia. He also has white material in his mouth, which is thrush, an overgrowth of a yeast called **candida**. Thrush is commonly seen in newborns and young babies, but really should not occur in healthy, young men. The appearance of thrush suggests that something has gone wrong with his immune system. He also has some swollen lymph nodes, which are most commonly seen during infections.
- One of the most common blood tests done is a **complete blood count (CBC)**, which counts the quantities of the three basic types of blood cells: the red cells, which carry oxygen; the white cells, which fight disease; and the **platelets**, which help blood clot when it needs to. In addition, a CBC usually includes a differential (or “diff”), which breaks down the white cells into subtypes.

- Our patient's CBC with diff shows that all three cell lines are low: He is anemic, with low red cells, plus he has low white cells and low platelets. The diff shows a striking lack of a certain kind of white cell called a lymphocyte, which typically accounts for about 50 percent of the total white cells. Our patient has zero. Maybe that's related to what we're suspecting is some kind of immune disorder—one that's led to a serious infection, or infections, that our patient is not shaking off.
- A chest X-ray is a very important test that is used in a variety of circumstances, both as a screening and as a confirmatory test. Essentially, it's a photograph of the chest, but one taken using X-rays—which can pass through body tissues but are blocked by denser things—rather than visible light.
- When a chest X-ray is done, we can assess the health of the bones of the chest, the condition of the lung fields, and the size and shape of the shadow made by the fluid-filled heart. Our patient's chest X-ray shows fluffy white areas superimposed across both lung fields, where instead of air there is excess fluid. That fluid blocks some of the X-rays, so you get areas that look more dense than air ought to look. There is some kind of widespread problem in the lungs.

## HIV/AIDS

- Acquired immunodeficiency syndrome (AIDS) is caused by the human immunodeficiency virus (HIV). HIV is a roughly spherical **virus** that is about 60 times smaller than a human **red blood cell** (which is actually rather large for a virus). It's one of a kind of viruses called retroviruses, which have their own unique enzymes and proteins that can insert their own genetic material into that of the infected host cells.
- Viruses are, in a way, not really living organisms. They don't have any way to extract energy from their environment and can't reproduce on their own. What they do is infect the cells of living organisms and use their own genetic instructions to take over the cell's machinery.

- The HIV virus takes the idea of controlling a cell one step further. As a retrovirus, HIV contains a special enzyme called reverse transcriptase that turns the virus RNA into DNA that is directly inserted into the DNA of the host cell.
- Furthermore, the HIV virus preferentially infects our own immune cells—the cells that are supposed to be fighting off infections. The host's own immune-fighting apparatus, instead of defending the body against HIV, is tricked into damaging our own cells and making more HIV virus to infect more of our cells.
- HIV doesn't necessarily make the host immediately ill. It can replicate and spread in a relatively small number of cells, leaving plenty of normal immune cells to do their job. It can take years for people with HIV infection to develop signs of serious illness.
- The diagnosis of AIDS is made when a person with HIV infection has clinical manifestations of disease, either caused by the virus itself or by an opportunistic infection. Without treatment, about 50 percent of people infected with HIV will develop AIDS within 10 years (though a small number of people seem to remain healthy indefinitely).
- In addition to destroying the host immune system, HIV infects cells in the brain (causing, eventually, a form of **dementia**) and perhaps cells in the gut and other tissues.
- Without a functioning immune system, serious illness can occur from out-of-control, ordinary infections. A fairly ordinary, innocuous infection can be much harder to clear and can have severe or prolonged symptoms. There are also less-ordinary infections, sometimes called opportunistic infections—which are caused by organisms that couldn't cause any problems for a healthy individual at all.
- Though we can still use antibiotics, antivirals, antiparasitics, and antifungal drugs to some benefit in AIDS patients, none of these

drugs works as well as they would in a person with a normal immune system. Drugs help our immune system fight infections; they don't knock out infections very well on their own.

- There are several different ways that HIV infections can present. There is an acute phase, occurring two to four weeks after initial infection. The symptoms are usually fever, aches, sore throat, swollen lymph nodes, and sometimes a rash or GI symptoms. The symptoms are not very specific, and many of these acute infections are not diagnosed as HIV. (One common misdiagnosis, at this point, is infectious mononucleosis.) Many people have no symptoms at all during this earliest phase.
- Then, there's a prolonged period of latency, where the virus slowly spreads without symptoms. Depending on the "viral load" (that is, how many virus particles there are in the blood), a person at this stage can be more or less contagious—in some cases, very high viral loads and infectivity can be associated with minimal if any symptoms, at least for a while.
- During this stage, patients can be found by routine screening of sexually active adults or others with risk factors. If symptoms are present, they might include chronic enlarged lymph nodes, fever fatigue, weight loss, diarrhea, or cough—all of these can come and go and may not overlap at the same time, which may make the diagnosis easy to overlook. Catching people early, in the latent stage, before obvious symptoms of AIDS develop, leads to a better long-term prognosis.
- Full-blown AIDS, which usually occurs within 10 years of exposure, includes more severe symptoms, including fevers with soaking night sweats, cough and shortness of breath, chronic diarrhea, plaques in the mouth, rashes, distorted vision, and persistent fatigue. Which symptoms predominate depends on which opportunistic infections are present.

## Testing and Treatment

- The most commonly used test for HIV is a blood test for antibodies to the virus, which usually becomes positive 3 to 12 weeks after infection during **seroconversion** (which is when the serological tests—the serum tests for antibodies—become positive). This delay in positivity means that someone with acute HIV, a new infection with symptoms, may still have a **negative** HIV test.
- In cases of suspected acute HIV, before seroconversion, a test for HIV genetic material in the blood using the polymerase chain reaction (PCR) technique can show infection. This same test, sometimes called the viral load, can also be used to see how heavily the blood is infected and, thus, how contagious a person might be.
- Another test commonly used in the evaluation and follow-up of an HIV patient is a CD4 count, a count of the T helper lymphocytes that are destroyed by HIV infection. A normal CD4 count is around 800 to 1,200; in advanced HIV and AIDS, this trends into the 100s or eventually down to zero.
- The most effective treatment of HIV starts early. There are medicines that can prevent the initial transmission of HIV—this can be used during the birth of a baby to an HIV-positive mom, after an inadvertent needlestick blood exposure for a health-care worker, or after an unsafe sexual encounter.
- When an HIV infection is diagnosed, there are about 30 different anti-HIV medications to stop the spread of the virus. These are used in a variety of combinations to make them more effective and also to prevent the virus from developing resistance. Current HIV medications need to be taken every day for the rest of a patient's life.
- We also have a number of medications to prevent and treat the opportunistic infections that cause a lot of the suffering in AIDS patients. Again, these need to be taken long term. Medication

regimens for AIDS and HIV patients can be complex and expensive and may lead to significant side effects. It's also crucial to help people with HIV infections maintain good overall health and nutrition and to take steps to prevent transmission to other people.

### Important Terms

**candida:** A common species of yeast.

**complete blood count (CBC):** A common laboratory test that quantifies the different types of cells in the blood.

**dementia:** A chronic disorder of brain functioning, most typically marked by memory problems in addition to other manifestations.

**fever:** An elevated body temperature.

**negative:** In medical use, “negative” means that the inquired symptom or finding is absent. It does not imply that this is good or bad.

**platelets:** A kind of blood cell involved in clotting.

**red blood cells:** The cells in the blood that carry oxygen.

**review of systems (ROS):** Part of the medical interview, with a series of questions organized by organ system to see if specific symptoms have been present.

**seroconversion:** When blood tests show that a person has been exposed to an infectious agent by demonstrating the presence of specific antibodies against that infection.

**virus:** A small infectious agent that does not contain its own cells or organelles.



## Suggested Reading

Garrett, *The Coming Plague*.

Shilts, *And the Band Played On*.

AIDS.gov, <http://aids.gov/>.

## Questions to Consider

1. What are some of the “new diseases” that first arose in the twentieth century?
2. What kinds of illnesses cause fever?

# Puzzling Pain

## Lecture 3

**T**he most experienced physicians know that sometimes our initial assumptions lead us astray. Keep an open mind, keep listening, and keep an eye on the patient in front of you. It's a mistake to only look for clues that support what you think you're looking for. In fact, the clues that don't fit are often the clues that are the most useful, the ones that eventually lead you to the correct diagnosis. This lecture will teach you how important the history and physical exam can be—how looking for details is essential and how we need to make sure that we do our job thoroughly.

### Abdominal Pain

- Imagine that a 36-year-old woman, Louisa, comes to our outpatient clinic with a chief complaint, in her words, of: "I'm tired of being in pain all the time." Louisa says that her main problem is abdominal pain, usually in the lower part of her belly, that sometimes gets better and worse but is essentially always there. It began four or five years ago and has gotten progressively worse.
- Because of the pain, she can no longer work. She's already seen a number of specialists, including a gastroenterologist, who diagnosed her with irritable bowel syndrome. Louisa is looking to us to review the whole picture and figure out what's going on.
- Louisa says that her pain is usually in her lower belly, below her navel. It doesn't really seem related to eating or drinking, or to any specific foods. Though she's had some occasional diarrhea, that's not usually a main problem. Her stools have never been hard, but she's been treated with a mild laxative because she has reported that passing stool is often painful. The laxative didn't help. She says that the pain doesn't seem to vary with her menstrual periods.
- She got the impression from a previous doctor that maybe the pain was all in her head, and she agrees that she feels stressed all the

time. Louisa says that she did see a psychiatrist, who diagnosed her with depression. However, the medicine the psychiatrist prescribed didn't help her feel better, so she stopped seeing him.

- Louisa is a woman with chronic lower abdominal pain. Though there are many causes of these symptoms, our history, review of systems, and physical exam fit best with something wrong with the lower GI system, or perhaps a gynecological problem.
- There's also been a suggestion from a previous doctor that somehow this is all in her head. Stress and psychological factors can certainly cause significant and debilitating symptoms, including chronic pain. But she already looked for help from a psychiatrist.



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**Abdominal pain is a symptom that is common to several different ailments.**

- Also, there is a huge gray zone between symptoms that are physical in nature and symptoms that have a psychological basis. Belly pain will be made worse by stress, whatever the original cause of the pain might be. A classic mind-body illness that straddles this line is irritable bowel syndrome, which a previous doctor had suggested as a diagnosis for our patient.
- Our next step is to look over the laboratory information. A CBC was normal—Louisa is not anemic, meaning that she probably hasn't been losing blood from her gut. That was confirmed with a negative stool test for blood. Knowing that there is no blood in the stool goes a long way toward ruling out significant gut inflammatory disease or colon cancer.

- Louisa also had two blood tests done—an **erythrocyte sedimentation rate (ESR)**, sometimes referred to as a “sed rate,” and a **C-reactive protein (CRP)**—to look for evidence of inflammation. These are very important, common tests. Both of these tests will be elevated if there is significant inflammation anywhere in the body. These tests do not tell you where the inflammation is or what’s causing it.
- Louisa has had several of these done over the years of her illness, and they were always normal. Other tests done included a normal screen for celiac disease and normal urinalyses.
- Our patient has also had an ultrasound study of her abdomen and pelvis. Ultrasound uses high-frequency sound waves—too high for humans to hear—that are transmitted from a transducing probe into the body. The sound waves echo off of body tissues back to the probe. Tissues of different densities have a varying ability to reflect sound waves, so the reflected information can be processed into a visual image.
- Ultrasound is transmitted at low energies, far too low to affect tissues, and there are no known ill effects from ultrasound medical studies. There is no radiation, and typically no sedation or **IV** contrast is needed. Ultrasounds are sometimes called sonograms; an ultrasound of the heart is commonly called an echocardiogram. These terms all refer to the same imaging technology.
- Ultrasound does have some limitations. It can’t peer very far into the body, so it’s not as useful for deep tissues and may be difficult to use in obese patients. Ultrasound also cannot produce images through bone. Still, it’s very useful for looking at the abdominal organs, including the kidneys, bladder, and liver, and it’s great for gynecological assessments of the ovaries and uterus and for peeking at an unborn baby.
- Louisa’s abdominal and pelvic ultrasound revealed no **pathology**. However, our patient finally disclosed that she has painful

intercourse, painful passage of stool, and infertility. Those three symptoms, together, are a classic triad for a cause of chronic abdominal or pelvic pain in women: endometriosis.

## Endometriosis

- Endometriosis is common. Probably about 15 percent of women have some degree of endometriosis, though the extent and severity of symptoms vary greatly. The normal endometrium is the lining of the uterus—tissue comprised of glands, blood vessels, and connective tissue that thickens and is then shed during each monthly cycle.
- In some circumstances, this endometrial tissue is found outside of the uterus—on the inside wall of the abdomen, on the ovaries, or nearby. It's unclear how this tissue gets there. It could spread during menstruation, or cells could spread through lymphatic or blood vessels. The cells of endometriosis are normal cells, just in the wrong place; this is referred to as “ectopic” tissue.
- These misplaced areas of endometrial tissue are what cause the symptoms of endometriosis. Pain is caused in part from bleeding, which may be cyclical. Recurring bleeding cycles can lead to scarring, especially because unlike bleeding in the uterus, the blood from endometriosis cannot be expelled from the body. However, the extent of endometriosis, the amount of ectopic tissue observed, doesn't always correlate with the degree of pain women experience.
- **Dyschezia**, or painful passage of stool, is a characteristic symptom of endometriosis, and it is also caused directly by the presence of endometrial tissue near the distal colon and by resulting scarring and **adhesions**. Women with endometriosis may experience painful symptoms intermittently, and they may or may not vary with their menstrual cycle.
- About 30 to 40 percent of women with endometriosis have problems with impaired fertility, perhaps also related to scarring and adhesions that alter the positioning of the ovary and fallopian

tubes. However, even mild degrees of endometriosis, without significant scarring, can lead to infertility.

- The treatment of endometriosis needs to be tailored to the individual case. Medical options include the use of a variety of **hormone** strategies to reduce the development of endometrial tissue, or to stop menses altogether. There are also surgical approaches to removing or destroying the ectopic endometrial tissue through minimally invasive, **laparoscopic** procedures. While this can be effective in reducing pain and restoring fertility, the degree of success can be difficult to predict.
- Laparoscopic approaches have the advantage of a much quicker recovery, less pain, less scarring, and a reduced risk of bleeding than traditional abdominal surgery. However, they may take a little longer, and not all procedures can be done using small laparoscopic tools. The surgeon also loses the ability to feel and use his or her hands directly.
- There are also even more advanced minimally invasive techniques, using devices to robotically assist the surgeon through even smaller or fewer openings, or even by using openings through normal body orifices, such as through the wall of the esophagus.

### Good Lessons

- There are some good lessons from our patient's prolonged diagnostic journey. It took several years for the correct diagnosis to be made, which is especially discouraging because there was effective therapy available. What went wrong, and what lessons should doctors and patients learn?
- Our first mistake was that there was an incomplete history. We knew that gynecological issues were a potential cause of symptoms, but we didn't ask about her sexual history. Knowing about one symptom, that intercourse had become painful, was a crucial diagnostic clue. It was overlooked perhaps in part because of embarrassment.

- Even doctors don't necessarily like to talk about these things. Still, if you're the patient, keep in mind that you need to speak up about symptoms that are bothering you. Don't wait for the doctor to ask, and don't assume that if the doctor didn't ask, he or she doesn't need to know.
- Another mistake was overlooking the necessity for a thorough and complete exam. Louisa was uncomfortable about anyone performing a rectal exam—probably because she knew it would be painful. But a gentle rectal exam could have revealed specific findings that could have helped the medical team reach the correct diagnosis sooner. A gynecological exam would have been diagnostic—but our patient had stopped seeing her gynecologist.
- Another issue was a lack of good collaboration on the part of the doctors involved. We're supposed to be a team, working together. But unfortunately, the ball got dropped, and more than once. Sometimes, the best diagnostic tool isn't a blood test or an **MRI**—it's just doctors talking to each other about the case so that everyone on the team knows what's going on.
- Another lesson is that we've all got our favorite tools and our favorite ways of looking at things. Our patient had been referred to a gastroenterologist early on, but the GI doctor was looking for GI diagnoses. In fact, the psychiatrist that the patient saw later was looking, mostly, for psychiatry diagnoses. An open mind, from all of the doctors on the team, helps avoid our putting on mental blinders that prevent us from seeing the correct diagnosis.

## Important Terms

**adhesion:** Surfaces stuck together, typically referring to organs and tissues within the abdomen.

**C-reactive protein (CRP):** A blood protein that can be measured in the laboratory. An elevated CRP is an indication of inflammation.

**dyschezia:** Painful defecation.

**hormone:** A substance secreted into the blood that controls functions at a distant site—for example, insulin.

**intravenous (IV):** Within a vein.

**laparoscopy:** A surgical procedure using optical instruments inserted through the abdominal wall to view the inside.

**magnetic resonance imaging (MRI):** Using a strong magnetic field and radio waves to get detailed images of internal organs.

**pathology:** Diseased tissue, or the collective features of a disease—or the branch of medicine that studies diseased tissues.

**erythrocyte sedimentation rate** (often abbreviated “sed rate” or “ESR”): A blood test of inflammation.

### Suggested Reading

Giudice, ed, *Endometriosis*.

Endometriosis.org, <http://endometriosis.org/>.

### Questions to Consider

1. What kinds of medical problems, other than diseases of the stomach, cause “stomachaches”?
2. Can a doctor determine if a bellyache is caused by psychological factors? How?



# Just Look at Me

## Lecture 4

**T**raditional medical education starts in the classroom. At many medical schools, the first two years are devoted to lessons in anatomy, biochemistry, physiology, etc.—to create a foundation of understanding of how the body works at times of health and what happens during times of disease. But even from the beginning of medical school, individual case histories are crucial and powerful teaching tools. For all of us in medicine, there is always more to learn. And we learn best from our own patients.

### Red Rash

- Jayden, a 10-year-old boy, is brought to the emergency department with a chief complaint of “Just look at me.” The remainder of the HPI was taken both from the child and his parents and older sibling, all of whom have accompanied him to the visit.
- Jayden had been in excellent health until five days ago, when he started to complain of feeling hot and tired. That night, he developed a cough and runny nose, and a fever began of 102 degrees Fahrenheit. The next day, his family noticed his eyes had turned red. His eyes have stayed red, and he has continued to run fevers from 102 to 104 degrees. Last night, his ears started to look red. Today, red spots have spread to his entire body. He says that the rash doesn’t really itch or bother him.
- Additional history and review of systems don’t reveal much. From his physical exam, we learn that his respiratory rate and heart rate are both elevated, and his blood pressure is normal. Overall, Jayden doesn’t look well.
- There are two concerning things on his exam that we had better deal with quickly. Even before we focus on the diagnosis, we need

to take some initial steps to address problems that may become life threatening if we don't act quickly.

- The first issue is his respiratory status. He's breathing quickly, at 40 breaths per minute, and fast breathing could mean that his lungs are not working as well as they should. He also has an overall kind of glassy-eyed, half-slumped appearance, which could be caused by a lack of oxygen delivery to his brain.
- We quickly use a device called a **pulse oximeter** to check the oxygen saturation in his blood. It is indeed low, at 90 percent. Before doing anything else, we should give him some extra oxygen by a special mask, and as we move along, we need to keep an eye on his respiratory status. Over the next few minutes, his pulse oximeter measurement improves.
- The second issue is that his heart rate is fast, and his mouth is dry. When asked, he doesn't remember the last time he urinated. Again, overall, he looks kind of glassy and wan and not terribly interactive. These findings suggest significant dehydration or even impending **shock**—which is when poor tissue perfusion starts to cause damage to vital organs.
- While we're asking more questions and working toward a diagnosis, we're not going to delay treatment for the dehydration. We quickly get him a small cup of juice for him to sip and refill it every few minutes to encourage him to continue drinking.
- Also, we'll ask our staff to start to make arrangements to transport our patient to the hospital. We don't know the diagnosis yet, but it seems like this child is going to need hospital care.
- There are many illnesses characterized by rash and fever. In this case, there is a rash and fever plus some additional hints. Our patient has pink eyes, fever, a cough, and what sounds like pneumonia with an abnormal chest exam. He also looks significantly ill. Put that together, and one rash-plus-fever illness seems very likely: measles.

## Measles

- Because measles seems to be a likely diagnosis, we're going to immediately take some steps to control the infection. We'll make a list of anyone who had been in the waiting room with the patient and all staff that interacted directly with this family. Measles is very, very contagious—perhaps the most contagious illness known to mankind.
- When moving the patient back through the office to the ambulance, we'll have him and his family wear masks; they may have measles, too. We'll also immediately contact the health department so they can investigate the home and community for other potential exposures, beginning when the child became contagious, four days prior to the appearance of rash. Highly contagious and dangerous illnesses like measles are a public health call to arms.
- Jayden was transported from the clinic to the ICU of the local children's hospital, and placed in a negative-pressure isolation room to prevent air from his room from flowing back into the hospital. Strict isolation precautions were followed, and his family members were monitored for illness.
- In addition to measles, our patient was also suspected of having pneumonia. Jayden had a high fever and severe cough, and he also had an abnormal crackly sound in his lungs and was breathing quickly, with a low oxygen saturation. Pneumonia was confirmed by a chest X-ray.
- Measles, the virus itself, can invade lung tissue and cause pneumonia. Once there is fluid from measles infection in the lungs, frequently a **secondary** infection caused by **bacteria** can set in. This is sometimes called a **superinfection**—when one invader takes advantage of a first viral or bacterial infection, causing a second infection on top of the first. Although we have no medicine to fight the measles pneumonia directly, intravenous antibiotics were begun to treat the bacterial superinfection.



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A vaccination is injected into a person to protect him or her from a specific disease.

- A confirmatory blood test for measles, called serology—which refers to blood tests on the liquid part of blood—was performed, which confirmed that Jayden did indeed have measles. Even though he was never vaccinated, our patient had high titers of anti-measles antibodies, confirming that this was a measles infection.
- There is no specific therapy for measles—nothing to kill the virus or make the infection itself milder or shorter. What we can do is provide fluids to support good blood circulation and extra oxygen, or ventilatory support, for the 1 in 20 measles patients who develop pneumonia as a complication. We also gave antibiotics, which can help if the secondary pneumonia is caused by bacteria.
- Another complication of measles is brain inflammation, called **encephalitis**. This can lead to **seizures** or permanent brain damage and occurs in about 1 in 1,000 measles patients. A much rarer complication is an untreatable, long-term degenerative brain disorder called SSPE that can start 10 years or more after

natural infection. Encephalitis and SSPE are more common in the youngest patients.

- In the developed world, with access to supportive care, the mortality rate from measles is about 1 or 2 out of 1,000 people. In the third world, the mortality is up to 1 in 4. Measles, though entirely preventable with vaccines, continues to kill about 160,000 children, worldwide, each year—which is down from 2.6 million deaths per year prior to the wide availability of vaccines in the 1980s. That's good, but we still have a way to go.
- Measles is a serious illness, but it is one that can almost always be prevented by a vaccine that is very safe. Unfortunately, the rate of measles is increasing dramatically in Europe and the United States. The single factor that has led to a resurgence of measles is falling vaccination rates, driven by an entirely unfounded fear of vaccines.

## Triage

- How did we know, up front, that our patient was very sick? This step is called triage—assigning a degree of severity to an ill or wounded patient so that the care team knows who needs attention fast. It's a crucial skill for all health-care workers to develop.
- Reviewing the **vital signs** is essential. This includes the heart rate, respiratory rate, and blood pressure. For all of these, numbers that are either too high or too low mean trouble, and the further from normal they are, the bigger the trouble you can expect.
- In children, the normal ranges of vital signs depend on the age of the patient. Babies normally have faster heart rates than children, who have faster heart rates than adults. Also, vital signs can be affected by factors like anxiety or pain.
- The patient's temperature is considered the fourth vital sign, and fever will also drive up both heart rates and respiratory rates.

- The pulse oximeter reading is sometimes considered the “fifth” vital sign. These devices are inexpensive and found in almost all offices and hospitals and provide a quick way to check on oxygenation.
- Children can have significant problems with respiration and oxygen delivery even with a normal pulse oximeter reading, so that reading has to be interpreted in the context of the overall picture.
- Even more important than these numbers in triage is the overall appearance or gestalt of the patient. A child who is interactive, smiling, talking, and playing is in good shape. A child who is listless, hard to wake, or just kind of “out of it” is the kind of child a pediatrician worries about the most.

### Important Terms

**bacteria:** A unicellular microorganism lacking a nucleus.

**encephalitis:** Inflammation of the brain, most typically caused by infection.

**pulse oximeter** (often abbreviated “pulse ox” or “POX”): A device that measures the pulse and oxygen saturation in blood.

**secondary:** A symptom or problem caused by some other medical problem. For example, a secondary headache may be caused by a sinus infection, concussion, or brain tumor.

**seizure:** A sudden disruption in the normal electrical activity of the brain, accompanied by altered consciousness, movements, or other neurologic manifestations.

**shock:** A life-threatening state of insufficient blood flow to multiple organs.

**superinfection:** An infection that occurs on top of a first infection.

**vital signs:** Collectively, clinical measurements of pulse rate, blood pressure, respiratory rate, and temperature.

## Suggested Reading

De Kruif, *Microbe Hunters*.

Offit, *Deadly Choices*.

Centers for Disease Control (CDC), <http://www.cdc.gov/measles/pubs-mmwr.html>.

## Questions to Consider

1. What kinds of illnesses are especially prevalent in travelers, or those born overseas?
2. How can you tell if a child is very sick—so sick that he or she ought to be in the hospital?

# Headaches in Wonderland

## Lecture 5

**M**igraines can be a very odd disorder. Although most patients' main migraine symptom is headaches, some migraine types cause unexpected neurological or other symptoms—sometimes without any headache at all. Sometimes patients' cases are messy and complicated, and sometimes the best strategies for prevention and therapy aren't clear. The case that you will learn about in this lecture is a satisfying one. It has a clear diagnosis and a good, effective plan for prevention and treatment.

### Sinus Headaches

- Gordon, a patient in the emergency department, comes in with the chief complaint of “I’ve got another one of these sinus headaches.” The patient is a 42-year-old male, who is actually well known in the emergency department. He says that he gets sinus headaches all the time. This one began earlier in the day, with a severe headache starting kind of over his right eye, though it has now spread to both sides of his forehead. He says that when he gets these, he almost can’t think straight, and his nose gets all stuffed up.
- Gordon has had six emergency department visits in the last four months. Every time, he complains about headaches and ends up getting IV fluids and pain medicines. He stays a few hours, feels better, and leaves.
- The classification of headaches starts with one question: Is this a primary or a secondary headache? Primary headaches are ones that occur without any other abnormality or specific pathology. These include migraine, tension, and cluster headaches. Although these kinds of headaches can be very painful and disruptive to life and work, they’re sometimes thought of as “benign” headaches because they don’t get worse and worse, and no one dies because of them.



- In contrast, secondary headaches are headaches caused by something else—something else that can be directly identified and treated. These include headaches from a brain tumor, an intracranial bleed, an abscessed tooth, meningitis, or—as our patient suspects—a sinus infection. Sudden or severe high blood pressure can also cause headaches.
- The secondary headache category also includes headaches that accompany many viral or bacterial infections, such as influenza or strep throat, or headaches caused by trauma. They can also be caused by **metabolic** disturbances, including low oxygenation or low blood sugar or from substance abuse or withdrawal.
- We are going to need more history and a physical exam. Headaches are almost always diagnosable based only on the history, with a physical exam to confirm suspicions. This is not a high-tech diagnosis. It involves going through some crucial questions with the patient to get an in-depth history.
- The most crucial headache question is as follows: Is this your first headache or your worst headache? That's very important—things like an intracranial bleed will cause a severe, worst-in-your-life headache, and that's a huge red flag for immediate action.
- More questions include the following: What happens when the headache starts? What symptoms develop with the headache? With migraines, there is often an aura—a visual or auditory phenomenon, such as flashing lights, that precedes the headache.
- Does the pain spread around? What does the pain feel like? Do you have any other medical problems? Are you stuffy all the time or just with the headaches? Is there anything that makes the headache get worse or better? Are you taking any medicines? What happens when you get a headache?
- After the questions have been answered, it's time for the physical exam. Gordon's vital signs are entirely normal, including a normal

blood pressure. His neck is not stiff. A head, eyes, ears, nose, throat (**HEENT**) exam reveals cloggy, nasal-sounding speech. There is no nasal discharge and no post-nasal drip. His eye exam is normal, including normal pupils and normal pupil constriction to light. Neurologically, everything is normal.

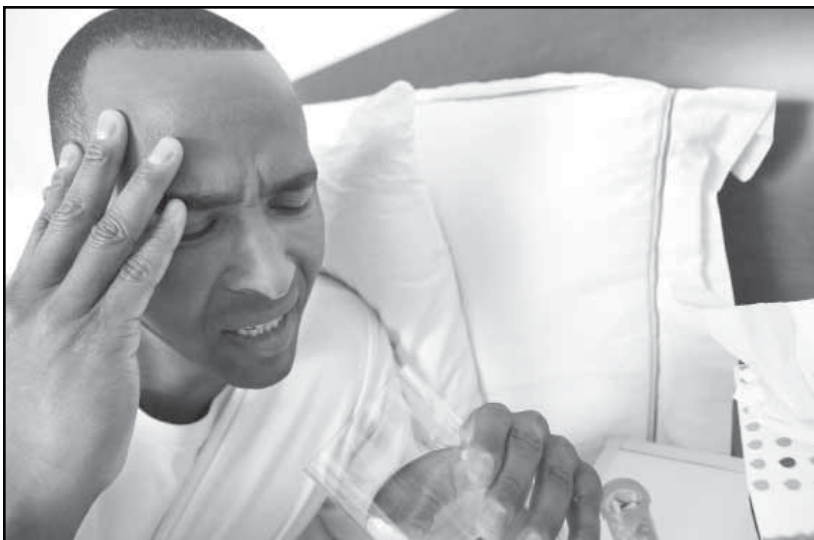
- The recurrent, nonprogressive nature of his symptoms and the lack of any abnormal findings on the physical exam weighs against almost all causes of serious secondary headaches.
- There are just a few other red flags to review—a few more indications that a patient is at higher risk for a serious, treatable cause of headache that we don't want to miss, including the following.
  - A progressive nature—headaches that are getting worse and worse.
  - A “worst headache ever” (sometimes also called a “thunderclap headache”).
  - Headaches accompanied by signs of infection, such as fever or stiff neck.
  - Headaches that change with posture or with coughing, straining, or sneezing.
  - Headaches accompanied by an abnormal physical examination.
  - Headaches in people with ongoing medical problems, such as cancer or HIV.
  - New headaches in people over 50 years old.
- Every item on this list relies only on the history and physical examination. We don't need any CT or MRI scans, or blood tests, for the vast majority of headaches that bring patients to the emergency department or to doctors' offices. There is no role for

advanced imaging or other tests, as long as there are none of these red flags in the history and physical examination.

- In Gordon's case, there are no red flags, so this is very likely to be one of the primary headaches. There really are only a small handful of common primary headache types; these are almost always migraine, tension, or cluster headaches.
- Tension headaches are common. They can last from 30 minutes to 7 days and have a pressing or tightening quality; they're not throbbing. The pain is bilateral—which means that it occurs on both sides of the head—and of mild to moderate intensity. They're not aggravated by activity and lack **nausea** and vomiting. Typically, they're not made worse with lights or loud sounds. Our patient isn't having tension headaches.
- Cluster headaches are less common, but they're really quite characteristic. The pain is brief—from 15 minutes to 3 hours, without treatment. They begin and stay unilateral and are accompanied by one-sided facial symptoms on the same side as the pain: a red or watery eye, congestion or watery nose, one-sided sweating, or one-sided pupil or eyelid changes. The thing to keep in mind about cluster headaches is how these symptoms are so striking and unilateral and that the headaches are really quite brief. Our patient isn't having cluster headaches.

## **Migraines**

- The most common primary headache disorder is migraine. These headaches last 4 to 72 hours and are unilateral (or at least begin unilaterally). The pain is of moderate to severe intensity and has a pulsating or throbbing quality. They get worse with activity, such as walking around or working.
- Migraines will always be accompanied by either nausea or vomiting or a combination of photophobia and phonophobia—which means that the headache gets worse with light and sound.



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**Migraines are severe headaches that occur again and again for a person.**

- Though not part of the definition of migraines, they characteristically improve after sleep. Gordon mentioned sleeping off his headaches. We've ruled out secondary headaches with our history and physical, and his headache pattern fits perfectly into the definition of migraine. That's our diagnosis.
- Often, migraines are accompanied by changes in what's called the autonomic nervous system, the part of our nervous system that's automatic—the things we don't have to think about. It includes the nerves that make us sweat and the nerves that constrict blood vessels and make the skin look pale.
- Some migraine sufferers become pale and sweaty, and many feel nausea or abdominal pain from these autonomic nerve changes. Autonomic nerves also innervate the lining of the nose and can cause nasal congestion or stuffiness from increased tissue swelling—explaining why our patient thought he was having sinus headaches.

- Some, but not all, migraines are accompanied by an aura. These are reversible neurological signs or symptoms that occur before the headache, or sometimes just as the headache is beginning. Common auras include changes in vision, such as sparkling lights or a colored haze. They can also include auditory hallucinations, or weakness, or a vague feeling of dread.

## **Treating Migraines**

- Dealing with migraines should always start with prevention. Many (though not all) migraines have specific triggers. These can include lack of sleep, hunger, dehydration, stress or illness, or sometimes bright lights or reading while in a car.
- People who have migraines should track their episodes and see if some of these common triggers seem to be part of the problem. Not all migraine sufferers have all of these triggers, but many have at least some, and some of these can be avoided through lifestyle modification, stress reduction, yoga, getting a good night's sleep, and other nonmedical steps. It's also very important for people with migraines to avoid falling into the trap of medication overuse and to modulate their caffeine intake.
- Beyond these preventive lifestyle strategies, migraine sufferers need an action plan to start as soon as possible when a migraine begins. For people who do have a warning aura, the migraine action plan needs to start as soon as the aura begins—which may be well before the actual headache. A migraine caught early is much more likely to be stoppable.
- A migraine action plan should include both medical and nonmedical steps. Usually, the patient will benefit from getting to a dark, quiet environment quickly. Sometimes a small snack, including some sugar, will help, perhaps even including some soda or coffee with caffeine. Although habitual caffeine use can lead to migraines, when taken at the start of a migraine, caffeine can help reduce its severity.

- Medicines can help, especially if taken at the start. These can include over-the-counter pain relievers like ibuprofen or acetaminophen. There are also very effective prescription migraine-stopping medicines. The best of these are in a family called the triptans. They all work similarly to block the brain receptor that is central to migraine development.
- All migraine sufferers who don't get full relief from over-the-counter products should have one of these triptans available for immediate use when a migraine begins. They come as pills and nasal sprays and in auto-injector devices that are especially useful for the many migraine patients who have vomiting with their headaches. Triptans, though very effective, can trigger rebound headaches if used too frequently.
- If, despite trigger avoidance and a good action plan, migraines are still occurring frequently, we ought to consider starting a daily migraine prevention strategy. This can involve adding a daily medication that can act as a migraine preventer. There are several of these available, though some can have side effects.
- There are also some more natural and potentially safer approaches to daily migraine prevention, including daily vitamin B<sub>2</sub> or magnesium supplements. Some studies have shown these to be quite effective in preventing migraines.

### Important Terms

**HEENT:** “Head, ears, eyes, nose, and throat”—referring to these areas of the physical examination.

**metabolic:** Related to chemical processes that sustain life.

**nausea:** A feeling of queasiness, or that one is about to vomit.

## Suggested Reading

Buchholz, *Heal Your Headache*.

## Questions to Consider

1. What are the red flags that mean a headache is caused by a serious illness that needs treatment right away?
2. How are sinus headaches different from other headaches?

# The Tennis Player

## Lecture 6

Cancer is a common disease—one that we’ve learned a tremendous amount about in the last few decades. It is a complex illness that can present in many ways, and we still have a lot to learn about prevention, screening, and treatment. In this lecture, you will learn about a case that illustrates the shortcomings of our knowledge. But even when a patient’s story turns bleak, there’s always something a physician can do to help the patient, even if the disease cannot be stopped.

### Non-Acute Pain

- Julie, a 52-year-old woman, comes to our general medicine outpatient clinic with a chief complaint of “I can’t play tennis anymore.” Julie says that she used to be a very active athlete, but about 10 years ago, she started having mostly right-sided hip and knee pains. She was diagnosed with osteoarthritis.
- She tried medical therapy with painkillers, injections, and steroids, but these were not very effective. Julie really wanted to get back to her active lifestyle, so she had right-hip replacement surgery eight years ago.
- She was able to return to active sports but continued to have some pain, now more on her left side, kind of in the front of her hip, or sometimes more in her left thigh. She complains now that this left-sided pain has gotten much worse, and she thinks she needs a referral back to orthopedics for left-hip replacement surgery.
- **Arthritis** would be on the top of our list of possible diagnoses. Arthritis of a joint means that there is more than just pain, but also evidence of inflammation with redness, warmth, stiffness, or changes on an X-ray. In adults, the most common cause of arthritis is chronic overuse (osteoarthritis) or infection in the joint or by autoimmune conditions like rheumatoid arthritis or lupus.



- We may also be dealing with a fracture—probably not a sudden, acute fracture, but perhaps a stress fracture, which is bone damage that develops more gradually, from overuse. There are other orthopedic and mechanical conditions that can cause hip pain, including bursitis and tendonitis. These, as well as muscle and tendon strains, are also caused by overuse. Our patient’s active lifestyle has put her at risk for all kinds of injuries.
- In addition to orthopedic and joint conditions, gynecological problems, such as endometriosis, can cause pain in the front of the pelvis, near the hip joint. Also, anything that presses or pinches a nerve that goes toward the hip can cause pain to be sensed in the hip area. Hip or bone pain can also be caused by cancer, including primary cancers of bone or bone marrow, or the spread of cancers from other sites.
- A physical exam reveals a bit of a fast heart rate, along with a firm mass, about the size of an almond, under her left armpit. It’s under the skin and freely moveable and feels like an enlarged lymph node.



© Fuse/Thinkstock

**It is very difficult for a doctor to tell a patient that he or she has cancer, but there are treatments that might help, and science is advancing every day.**

- Our first, simplest test is a set of X-rays. There's an area of bone at the top of the femur, near the hip joint, that looks kind of irregular and splotchy. It's not a simple fracture; this is an area of abnormal bone—maybe a cyst of some kind, chronic bone infection, or some kind of cancer. It is not arthritis.
- The CBC shows anemia, with a decreased amount of red blood cells. In general, this can be caused by either blood loss or by decreased production of red cells. The remainder of the cell lines, the platelets and white cells, are normal. The labs also reveal an increased sed rate, meaning that some kind of inflammation is going on, somewhere.
- A great diagnostic tool—and sometimes underappreciated—is collaboration between doctors. Our patient, it turns out, has never had a mammogram. An oncologist does one the next day, revealing a suspicious breast mass on the left.
- After consultation between Julie, the primary care doctor, oncologist, and surgical teams, the decision is made to proceed immediately with an open biopsy of the breast mass. Although a needle biopsy could have been done first, doing a less-invasive test before surgery, Julie felt that whatever was going on, she wanted to know for sure—and as soon as possible.
- Tissue during surgery is examined by the pathologist, who confirmed seeing the abnormal cells of breast cancer. The surgical procedure is extended to remove the chains of nearby lymph node, several of which also turn out to be positive for containing cancer cells.

## Cancer

- Our final diagnosis is breast cancer with **metastatic** spread to the local lymph nodes and bone, both near the hip and other sites. Sharing news like this isn't a one-time event; it isn't one big talk at which all questions are answered. Discussions like this should always end with plans for the next discussion and open-ended time for families and doctors to share how they feel.

- Cancer, at its core, is a genetic disease—that is, it’s a disease that affects the genetic material of the cells. Every cell is governed by the instructions carried on its chromosomes, the genes that encode the proteins that control every function of every cell. Cancer cells are cells that have lost the ability to control their own growth and differentiation, and they grow and spread far beyond the tissues that they ought to call home.
- There are two kinds of genetic changes that can lead to cancer. First, there are germ line mutations, which are genes that are present way back in the embryo, passed on from mother or father, and are present in every cell in the body. These mutations are hereditary, meaning that you’re born with them. Hereditary mutations account for about 10 percent of all cancers.
- The second kind of genetic change occurs only in a single cell—a mutation or mistake that’s created when the cellular genetic material is copied to make new cells. Sometimes this happens just randomly, but for many kinds of cancers, we know what things cause at least some or most of these cellular changes.
- Radiation, including solar radiation, can disrupt or damage DNA, as can environmental toxins or smoking. Certain infections can also directly cause certain cancers, or chronic infections can lead to chronic cell damage that can eventually lead to cancer.
- Although there are both somatic and germ line kinds of mutations, many cancers are related to not one genetic change, but several overlapping conditions. Although cancer is always genetic, it usually arises from a combination of contributions from multiple genes, sometimes (but not always) including hereditary genes carried in families.
- One very common risk factor for almost all cancers is age. The longer our cells have been alive, the more years they’ve had to sustain the damaging hits on their genetic material that lead to cancer. Almost all cancers increase in frequency with age, and in

fact, it may be true that if we live long enough, eventually we will all get some kind of cancer.

- Cancer isn't one disease. Any tissue can develop cancer, and often, there are potentially multiple types of cancer even in one kind of body tissue, all of which have different health consequences and treatments. But whatever the initial cause and whatever the kind of cancer, what all cancers have in common is that the genetic mechanism that should have controlled the growth and spread of the cell fails, and the cell keeps dividing and growing and spreading.
- The signs and symptoms of cancer can be almost anything. They depend on where the cancer is, how fast it's growing, and whether it's pushing on blood vessels, nerves, or other crucial tissues. Some cancers themselves release chemicals into the blood that cause symptoms in any part of the body. Cancers can also cause symptoms if they spread or metastasize to other areas.
- There are sometimes constitutional symptoms of cancer. There may be prolonged and difficult-to-explain fever, weight loss, or marked fatigue. These symptoms may occur because of the metabolic demands of the growing cancer tissue or in part because of the body's immune system trying to attack and fight off the cancer. However, breast cancer often occurs with none of these constitutional symptoms.
- Immunity, or a lack of immunity, is an important part of cancer biology. Our immune systems are there to fight off foreign invaders, and we think of invaders as infections like bacteria or viruses that barge into our bodies from outside. But cancer cells are also, in a sense, foreign invaders—invaders from the inside.
- Our immune systems have developed to be very good at sniffing out and destroying these cancer cells. People with immune deficiencies, or altered immune systems for other reasons, are at higher risk for developing many kinds of cancer.

## Treating Cancer

- Surgery is the primary, main therapy for breast cancer, and surgery alone can be curative when breast cancer is caught early. After surgery, many women with early cancer pursue what's called adjunctive therapy, which refers to things done in addition to the primary therapy—surgery—to increase the chance of cure or long-term survival.
- Although theoretically an early cancer shouldn't have spread to outside tissue, we can't know if a few cancer cells have snuck out—and even a few cells, or one cell, can continue to grow and allow cancer to spread. Adjunctive therapy for breast cancer includes mainly chemotherapy, hormonal therapy, and radiation.
- Chemotherapy refers to drugs given to kill cancer cells or halt their spread. It's most effective on rapidly dividing cells, and different kinds of breast cancer may be more or less sensitive to chemo. The chemotherapy drugs are often more effective when used in combinations. Although side effects may be very difficult, we have gotten better at managing many of them.
- Many, but not all, breast cancer cells have receptors for female hormones. If they do, medications to block hormones can prevent cancers from spreading.
- Radiation therapy can also be used to destroy rapidly dividing cancer cells, though there are side effects and dose limitations. These adjunctive therapies can be used to increase the chance of long-term survival or as palliative therapy to extend life and provide comfort, even in patients who cannot be cured.

## Important Terms

**arthritis:** Joint inflammation, typically manifested by stiffness and pain accompanied by swelling.

**metastatic:** Cancer appearing at a site distant to the original cancer, caused by migrating and then proliferating cells.

### Suggested Reading

Link, *The Breast Cancer Survival Manual*.

Mukherjee, *The Emperor of All Maladies*.

Weinberg, *The Biology of Cancer*.

American Cancer Society, <http://www.cancer.org/>.

### Questions to Consider

1. What is the best way for doctors to communicate bad news to patients?
2. How do you know if a screening test is a good idea?

# Sudden Collapse

## Lecture 7

The person in front of you collapses to the floor. You have no time for a chief complaint or history. There is a woman lying on the floor in front of you, and she looks to be about 50 years old. She is pale, and she's taking what are called **agonal** respirations: just the barest gasps that occur when a person is near death. Within moments, even these respiratory efforts stop. What do you do?

### Layman/Bystander CPR

- Depending on your expertise, it may be appropriate to take different steps, but the following are basic lifesaving steps that anyone can do. The first few minutes are critical.
- Most importantly, it is much, much better to do something than to do nothing while you try to remember what you're supposed to do. You don't need to be perfect and 100 percent follow the guidelines and the exact methods of CPR, but you'd better act fast.
- When you come across someone who appears to be dead, follow these steps.
  1. Make sure the person isn't just sleeping or lying still. Give him or her a shake. Yell, "Are you okay?" In our example, this person just collapsed in front of our eyes. You can probably skip step 1.
  2. Yell for help. Call out, "Someone call 911." If there are people nearby, point to one person specifically and tell him or her to make that call.
  3. If you're in a public place, such as a mall or sporting event, and someone is around to help you, tell someone to go get you an automated external defibrillator (**AED**). Many places—including gyms, department stores, schools, and churches—

now have these devices available. If one of these is available, using one as quickly as possible is the single best way to improve survival.

4. While waiting for someone to call 911 and get the AED, start rescue CPR. Roll the person onto his or her back. Start pushing right in the middle of the chest, hard and fast. Use two hands, one on top of the other, and after every push, relax so that the chest can bounce back up. You shouldn't stay leaned into the chest—it's down, up, down, up. A good rhythm is the beat from the song "Stayin' Alive" by the Bee Gees (think "push, push, push, stayin' alive, stayin' alive").
5. Keep going, pushing hard and fast, until either trained emergency rescue personnel show up or someone runs over with the AED.
6. If you have an AED, follow the instructions on the device. Studies have shown that even school-aged children can use these correctly. There will be a cartoon on the front showing the steps and a big "ON" button—pushing that is the first step. After that, the machine will have voice prompts to tell you exactly what to do. You will put a big sticky pad on the front of the chest; then, make sure no one is touching the victim. The computerized device will monitor what the heart is doing, and if appropriate, the device will tell you to push the "shock" button to deliver a jolt of electricity to start the heart beating again. An AED is a smart and safe device—it will not suggest



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**If you notice that someone collapses near you, you might need to perform CPR in order to save his or her life.**



giving a shock to a normally beating heart, and in fact, the “shock” button won’t do anything if you push it unless it’s safe to give a shock to the victim. After the shock, the machine will analyze the heart rhythm again and continue to tell you what to do.

- If at any time during the rescue process the victim starts to respond—that is, starts to move or takes breaths—stop what you’re doing, roll the patient to lie on his or her side, and wait for rescue personnel.
- The newest guidelines for bystander CPR have de-emphasized some of the traditional parts of CPR that had been taught. Rescuers are no longer encouraged to even check for an open airway and breathing; that used to be the first step, but that’s been dropped, because it turns out that the faster you start pumping by pressing on the chest, the better chance the victim has. Don’t check pulses; don’t mess with the airway. Don’t even bother with mouth-to-mouth resuscitation or rescue breaths. Just jump in, push hard, and push fast—while calling for help and for someone to get you an AED.
- There are some situations where other approaches to CPR are needed. First, you have to be safe yourself to do CPR. If a victim is in a busy street or is drowning, it may not be safe for you to approach. Do not endanger yourself to do CPR.
- Also, children and babies need a different kind of CPR. For young people, it’s unlikely that a cardiac problem has caused their collapse; much more likely, it’s something like choking or a problem with breathing. For children, you should open the airway and give rescue breaths before pressing on the chest.
- For any choking victim, adult or child, remove any visible blockage from the airway before proceeding with CPR—but even if you can’t inflate the lungs, continue those chest compressions.

- Some people might hesitate to help a stranger who has a sudden collapse because they might worry about malpractice lawsuits that might occur if resuscitation is unsuccessful. Every U.S. state and many countries have so-called Good Samaritan laws that protect people from lawsuits if they stop to help someone who appears to be in mortal danger.

## Heart Attacks

- Almost all causes of sudden collapse are from the heart, from some condition that suddenly stops the heart from beating. The most common cause of this is what is colloquially called a heart attack, or myocardial infarction (MI). This is when a lack of blood flow to the heart muscle itself causes the death of heart muscle cells. It's often accompanied by a sudden change in the heart rhythm, a so-called **arrhythmia**. Instead of the heart beating in an organized way that effectively pumps blood, it just kind of quivers.
- No blood flow to the brain means that the body will collapse and die quickly. Sudden arrhythmias can also occur because of other conditions, including genetic predispositions to sudden death that can run in families.
- Historically, heart attacks have been thought of as a disease of a certain kind of person: usually, a successful, driven, type A kind of man. However, heart attacks are in fact the leading cause of death among women.
- Although our ability to deal with and treat a heart attack has become increasingly effective, we're still seeing an increasing impact of heart disease. This is mostly because it is so difficult to effectively modify well-known risk factors for atherosclerotic heart disease.
- The heart is, essentially, a muscle—a not-too-large muscle, but one that has to contract and relax and contract and relax, continuously, without a rest. Like any other muscle or living tissue, the heart needs oxygen, carried by blood through the coronary arteries that course along the surface of the heart. If these coronary arteries get

blocked, there won't be enough blood flow or oxygen, and parts of the heart muscle itself will be damaged or killed.

- The most common reason for blockage of flow through the coronary arteries is atherosclerosis: the buildup of plaques along the walls of the coronary blood vessels. A similar process can occur in blood vessels leading to the brain, causing stroke, or to other blood vessels affecting other organs. Therefore, the risk factors for stroke and heart attack overlap in many ways.
- It's commonly thought that atherosclerotic plaques are made of fatty deposits, but that is an oversimplification. Although fats, or lipids, do contribute to these plaques, there are also inflammatory cells, scarring, and clotting cells and proteins that contribute to the plaques.
- These so-called atheromas start to develop in the teens and twenties and slowly proliferate. Longstanding, stable blockages can lead to the natural development of collateral vessels—new vessels that can bypass the blockage to deliver blood. Atherosclerotic plaques can lead to symptoms in several different ways.

### **Prevention and Screening**

- The prevention of heart attacks is really the prevention of the development of atherosclerotic plaques. There is a tremendous amount of research, looking at multiple overlapping and additive risk factors. The most important ones are as follows.
  1. A healthy lipid profile. We don't just look at the total cholesterol; the specifics are important. But the bottom line is that a healthy diet, healthy weight, and an active lifestyle lead to more healthful blood lipids and decrease cardiovascular risk. Even with great lifestyle habits, some people will still have unfavorable lipids because of genetic predispositions. For these patients and for patients who are unable to sustain healthy life habits, medications may help reduce lipid risks.

2. Healthy blood pressure. Increased blood pressure contributes to the development of plaques and also forces the heart muscle to work harder and need more oxygen. A healthy blood pressure depends on both lifestyle and genetic factors.
  3. Healthy weight. Excessive fat tissue contributes to inflammation and atherosclerosis, and risk factors for obesity overlap with those for unhealthy lipids and increased blood pressure.
  4. Preventing and treating diabetes. Primarily, this is a matter of healthy eating and healthy weight—but there is a big contribution of genetics as well. It is not fair to assume that all of these risks are only because of lifestyle choices.
  5. Avoiding smoking, which dramatically increases the risk of heart attacks, especially when combined with other risk factors.
- To help identify problems early, it is important to screen for heart disease risk in healthy people. Current recommendations stress low-tech screenings that are safe and effective. These include measuring blood pressure at least every two years, measuring blood lipids every five years, following body weight, and screening for elevated blood glucose (a manifestation of diabetes) starting at age 45. Regular counseling regarding smoking cessation and maintaining healthy diet and exercise habits is also recommended.
  - There are also some higher-tech tests that may be helpful for people at higher risk for cardiovascular disease. A stress test forces the heart to work harder—while running on a treadmill, a continuous **EKG** reading looks for early signs of insufficient oxygen to the heart muscle, called ischemia.
  - A newer test is a cardiac **CT scan** to measure calcium deposits around the heart (calcium being one constituent of atherosclerotic plaques). These are sometimes advertized heavily to the general

public, and it's unclear exactly who should get these tests or how to interpret the results. They're not recommended for routine use.

## Important Terms

**AED:** Automated external defibrillator.

**agonal:** Occurring just before death.

**arrhythmia:** An irregularity in the heart rhythm. Although this term is used commonly, a more exact term that is preferred is “dysrhythmia.”

**computed tomography scan (CT scan):** A study that uses a series of X-rays to construct two-dimensional images of internal structures.

**EKG:** Electrocardiogram—sometimes abbreviated ECG.

## Suggested Reading

Mayo Clinic, *Mayo Clinic Healthy Heart for Life*.

American Heart Association, <http://www.heart.org>.

## Questions to Consider

1. What is the first thing to do if someone next to you collapses on the floor?
2. What are the best ways to prevent heart disease—and why is there so much heart disease in the United States?

# School Failure

## Lecture 8

What do these three people have in common: a teenager failing school, a 40-year-old woman who has lost 10 pounds in the last few months, and a 70-year-old man who is becoming more and more forgetful? These are all presentations of depression. To a teenager, depression is presented by irritability and school failure; to an adult, perhaps disinterest in eating and taking care of herself, leading to weight loss; in an elderly person, disrupted thinking that may seem very much like forgetfulness. The good news is that depression is a treatable condition. These are not things that people just have to learn to live with.

### Not Doing Well in School

- A 15-year-old patient, Trevor, is brought to our office by his father. When asked, he has no chief complaint, or at least he's not willing to say one. His father says that Trevor is failing school and is maybe falling asleep in class.
- A brief **differential diagnosis** can be broken down as follows.
  - Group 1 includes psychiatric problems, including depression or other mood disorders, plus substance abuse and attention deficit disorder. Less commonly, something like schizophrenia can begin at this age.
  - Group 2 would be what we'll call primary school problems, including bullying or social issues at school, or a learning disability.
  - In group 3 go primary medical problems, including disorders that prevent adequate quality of sleep or things like narcolepsy that cause excess drowsiness. You'd also include any primary brain disorder that could prevent learning or focusing. Hypothyroidism, among many other symptoms, can cause cognitive slowing and perhaps excessive sleepiness.

- What's especially tricky in this case is that there is a lot of overlap between the groups. For example, if for some "medical" type of reason he's having trouble focusing on his lessons, that might be leading to poor self-esteem and perhaps even bullying—which could lead to social isolation and symptoms of depression. There could be multiple, interconnected things going on for us to untangle.
- Trevor's past medical history is entirely unremarkable. The family history is positive for bipolar illness in an uncle on the father's side. The father says he himself has taken medicine for depression in the past, but he says that he "really didn't need it."
- Trevor presented several complexities. In addition to symptoms of depression, there was some evidence of a preexisting learning disorder, dyslexia; there was also the possibility that his cognitive problems could have been at least partially blamed on his history of **concussions** from playing football.
- A comprehensive psychological evaluation was performed to separate these factors. His primary diagnosis was confirmed to be major depression, with a secondary diagnosis of dyslexia.
- For the depression, Trevor was initially treated with medication alone; after some improvement, cognitive behavioral therapy was added a few months into treatment. Although he did have to repeat part of the school year, within about four months, he was doing well socially and academically.
- We do know that adolescents who experience depression have a high rate of relapse as adults, so it will be important for Trevor to continue to be monitored. There is some evidence that early recognition and aggressive therapy of adolescent depression may lessen the chance of adult relapse—or at least make recurrences milder.
- An important lesson to remember is that children are not little adults, and health issues in children and teenagers present differently from health conditions in adults. Depression in young people may have

as major symptoms school problems and irritability instead of the sadness and hopelessness seen in adults.

- Another key lesson is that a variety of things can cause children to do poorly in school. These can include medical problems (such as a sleep disorder), school issues, or psychiatric conditions.
- Psychiatric conditions, such as depression, can present with a variety of vegetative, mood, and physical symptoms. In other words, psychiatric diagnoses should always be on the list of the differential diagnoses of any physical problem, and our differential diagnoses of psychiatric complaints should always include medical diagnoses, too. The boundaries are often fuzzy and sometimes misleading.

### Major Depression

- It's important to make the distinction between depression—that is, the common word meaning “sadness”—and depression, the pervasive emotional disorder with specific symptoms that span far outside the realm of sadness. Of course, we all experience sadness related to life's disappointments, bereavement, and ordinary turmoil.
- When we speak of depression as a diagnosis, we're referring to something not only more intense in quality, but also broader in its effect on lives and families. Sometimes, the medical diagnosis is referred to as “major depression” to underscore this difference.
- The first primary symptom of depression is depressed mood. This can be something reported by the patient—for example, “I feel sad a lot”—or something noticed by the family. In teenagers, a depressed mood can come across as more of an irritable mood, with frequent fighting and outbursts. To qualify as major depression, the depressed mood occurs most of the day, nearly every day. Our patient was at times sad and at times quite irritable.
- The second main symptom is a lack of interest in pleasurable activities. In teenagers, this often presents as social withdrawal, dropping out of activities, or spending very little time with friends



or hobbies that used to be enjoyable. One or the other, or both, of these two main symptoms of withdrawal and depressed mood are always present in major depression. Our patient had both.

- There are also a number of other symptoms, and for a formal diagnosis, at least four of these must be present to confirm the diagnosis of depression.
- So-called vegetative symptoms affect our basic life functions. There can be significant changes in appetite leading to either weight loss or weight gain. Depression can also affect sleep cycles, leading to either reduced or increased sleep. Even when there is a lot of sleep, fatigue or loss of energy is reported.
- There are also qualitative and quantitative changes in thinking patterns. Many patients with depression experience cognitive slowing, or a lack of ability to think or focus. Thoughts that do occur are often preoccupied with feelings of guilt or worthlessness that may even border on delusional—sometimes patients blame themselves for many things that are clearly not their fault. There can be pervasive hopelessness and recurrent thoughts of death, which may include thinking about suicide or planning or performing a suicidal act.
- Although the symptoms of depression in children and adults are similar in many ways, there are some significant differences. Teenagers are as likely to present with irritability, anger, or abusive language as with sadness. They more often have somatic complaints, such as bellyaches, headaches, nausea, or dizziness. In fact, chronic unexplained pain should always raise the suspicion of depression as a possible diagnosis.
- Depressed teens often complain of being bored and have low energy. They may become extremely sensitive to perceived rejection or lack of success. School absences and/or decreasing school performance are nearly universal findings in childhood depression.



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**Depression manifests itself in many ways, especially for adolescents.**

- Depression is a serious problem. About four to eight percent of adolescents experience a major depressive episode each year, leading to substantial problems at school and at home. Depressed teens may fail in school, lose their jobs, or turn to drugs of abuse. In addition, depression contributes to most cases of suicide, which is now the number one killer of young adults in the United States.

### **Risk Factors and Treatment**

- There are clearly both environmental and genetic factors that contribute to the development of depression. Risk factors for children can include a history of neglect, abuse, loss of a parent (especially the same-sex parent), psychosocial deprivation, or chronic illness. However, although these factors increase the risk of depression, most children with, for example, chronic illness do not become depressed.
- In addition, whether stresses are accompanied by a supportive family may influence the possible development of depression.

Familial or genetic factors also play a role in how resilient people can be to life's stress.

- There are several ways to treat adolescent depression. Certainly, helping to create a supportive home and school environment is essential, as is trying to gradually get the patient involved again with pleasurable activities and exercise. Sleep habits and daily routines may need to be normalized.
- Any coexisting anxiety or other mental problems, substance abuse, learning problems, or medical issues need to be evaluated and addressed, even while pursuing active therapy for depression.
- Psychotherapy can be effective, especially for mild-to-moderate depression. The most well-studied form of therapy is called cognitive behavioral therapy, which at its core is an application of the idea that our thoughts cause our feelings and behaviors.
- Although talking is of course involved, cognitive behavioral therapy isn't just talking about feelings—it's a focused approach to help patients learn to recognize their own thoughts, learn how they lead to distressing symptoms, and most importantly, how to change the way they think about things. Psychotherapy isn't as effective for more severely affected patients and may take weeks or months to help.
- The other effective therapeutic option is antidepressant medications. These aren't in any way "happy pills." They do not work quickly, but over the span of weeks, these medications can help with the mood and physical symptoms of depression.
- The most widely used group of these medications are called SSRIs. Overall, SSRIs are quite safe and well tolerated. However, some studies have showed an increase in suicidal thoughts (though not actions) in the first weeks of therapy, leading to an FDA warning on the label concerning the suicide risk. Ironically, the drop in SSRI usage caused by concerns raised by this warning has led to a net

increase in teen suicide, probably because fewer teens could get effective therapy.

### Important Terms

**concussion:** Brain trauma leading to symptoms of brain dysfunction.

**differential diagnosis:** A list of candidate diagnoses to explain a medical problem.

### Suggested Reading

Barkley, *Taking Charge of ADHD*.

Burns, *Feeling Good*.

Solomon, *The Noonday Demon*.

WebMD, <http://www.webmd.com/depression/>.

### Questions to Consider

1. Why do some teenagers do poorly in school?
2. How are teenagers and adults different? Why should their medical problems be evaluated differently, and how?

# Dizzy Attacks

## Lecture 9

The last three lectures have been common diagnoses—breast cancer, heart disease, and depression. This lecture requires a little more of a mental stretch. The case in this lecture strikes about 1 in 1,000 adults per year. In a typical, busy medical practice, full-time doctors probably have about 1,500 patients they see regularly, so each year, they're likely to see a few cases of this. So it's not common, but it's not so uncommon either. The presenting symptom, dizziness, is very common.

### Dizziness

- In our general medicine clinic, a 42-year-old woman named Tina says that for the last few months, she gets these “attacks” where all of a sudden she gets dizzy. She can't stand up straight, and sometimes she hears a buzzing or high-pitched sort of noise. She says that she sort of staggers around and has to eat a candy bar. Once she has some sugar, in about a half of an hour, she starts to feel better.
- These episodes are getting more intense, more frequent, and are lasting longer—now, she says, sometimes she has to eat two candy bars. Her friends have told her that she's either having **hypoglycemia** or that she's just crazy.
- Dizziness can be a challenging symptom because different people use that term to refer to different things. Dizziness can mean **vertigo**—which is a sensation of spinning, as if the environment is moving around you. True vertigo is usually caused by problems with the inner ear, where the sense organs of balance are.
- Dizziness can also refer to a lightheaded feeling, like you're going to faint. That's a completely different problem, with different physiology to think about. Dizziness in this sense is usually caused by insufficient blood flow to the brain.

- Less frequently, a feeling of dizziness can be related to feeling unsteady or off balance, caused by problems with the brain, nerves, or muscle. This can be related to a loss of either nerve input to the brain—conditions where there’s a loss of sensory input, so a person can’t sense, essentially, where their feet are; or a condition that affects motor function, causing weakness and unsteadiness. These are neurological problems and are most often present in elderly people.
- Finally, dizziness can be a psychological or psychophysiological effect, when a person feels kind of disconnected or disassociated with the world’s sensory signals. In that case, a psychological assessment is most helpful.
- Tina clarifies by saying that the feeling she keeps having is a spinning feeling—like the room is spinning, round and round. She says she doesn’t feel faint, and she’s never passed out, but she is afraid she’ll fall down. This is true vertigo.
- Because she also mentioned that she hears an unexplained buzzing or high-pitched sound, we can be pretty sure that this is an ear problem, specifically with the inner ear, where hearing and balance sense organs are located. That would explain the combination of vertigo and a hearing issue.
- Tina’s history and physical exam support a clinical diagnosis of episodic vertigo. The main symptom of problems along the pathways of the balance system, from the balance organs through the nerves to the brain area that interprets the data, is vertigo—a sensation of movement in space when there is in fact no movement.
- The most common cause of vertigo is called benign paroxysmal positional vertigo (BPPV). It causes brief (less than one minute) episodes of vertigo triggered by a position change, such as turning over in bed or quickly looking up.



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The inner ear is involved in regulating our sense of balance.

- It's caused by a problem in the balance sense organs themselves, by debris in the semicircular canals. The symptoms and **nystagmus** can be recreated in the office by moving the head in the plane of the effected canal. Tina's vertigo attacks last too long to be typical of BPPV.
- Labyrinthitis refers to inflammation in the balance and hearing organs. The vertigo can be made worse by positional changes and usually last days to weeks. Tina's symptoms have come in recurrent, isolated attacks that have come and gone repeatedly—which really doesn't fit the typical presentation of labyrinthitis.
- Another problem that can occur in the sense organs of balance is called Ménière's disease. Although we don't know exactly why it occurs, it seems to be caused by excessive endolymph fluid that interferes with the functioning of the balance organs. Ménière's patients, in addition to having periods of intense vertigo, often

also suffer from hearing problems, because that same excessive endolymph affects the functioning of the cochlea.

### **Ménière's Disease**

- For Tina, it sounds like Ménière's disease fits best because it causes attacks of vertigo that come and go, like Tina reports, and also affects hearing. Other diagnoses, such as a tumor or multiple sclerosis, seem much less likely, but after discussing these possibilities with Tina, she decides that she would like to pursue a very thorough workup.
- To definitively rule out a tumor, we need a brain scan—one that looks along the entire pathway, from the sense organs along the nerve to the brain. A CT scan is a very good study; it's relatively quick to get and can show pretty good detail, especially of bones.
- However, there are drawbacks. CT scans are basically a series of plain X-rays that are stitched together by computers to make composite images. Like other X-rays, they rely on ionizing radiation to get an image. Though the risk is small, any study involving radiation will expose the patient to some risk of damage from the radiation itself, increasing the lifetime risk of cancer.
- In contrast, an MRI scan of the brain doesn't use any ionizing radiation. It also has the advantage of imaging soft tissues like the brain with much more precision than a CT scan. MRIs are also better able to get images through the dense bones of the base of the brain, where CT scans don't penetrate as well—and, with balance problems, we need to look at the base of the brain, where the balance and sense organs are.
- The main disadvantages of MRI compared to CT are that they take much longer to do, and they are more expensive. In Tina's case, we decided to get an MRI to rule out even a small tumor, and it was normal. The MRI scan also showed that there were no brain **lesions** to suggest multiple sclerosis.



- After the MRI, we referred Tina to an **ENT** specialist, who reviewed the clinical exam and MRI and did a hearing test (which did confirm some low-frequency hearing loss). The ENT evaluation confirmed that Tina does indeed have Ménière's disease.
- The specific cause of Ménière's disease isn't completely understood. There is increased endolymph fluid, as well as differences in the glycoprotein content of the fluid; there's also evidence for alterations in the way that the fluid flows through the canals and is reabsorbed. Some studies have supported an infectious agent, genetic influences, or allergies—or a combination of these factors.
- Whatever the cause, the main symptom is episodic attacks that last for one or more hours. During attacks, there is vertigo, often accompanied by a ringing, rushing, or buzzing sort of sound (called tinnitus). There may also be a feeling of pressure or fullness in the ear.
- Accompanying these attacks is a gradual, fluctuating level of low-frequency hearing loss that can become severe and is only reversible if caught early. The pressure feeling and hearing loss usually affects only one ear, but it can affect both.
- Ménière's disease is a clinical diagnosis; there is no one specific test that confirms it. Tests are done, sometimes, to rule out other diagnoses (like the MRI Tina had). Blood tests are really of limited usefulness in the workup, though they can again rule out other problems if there are suggestive symptoms. Doing a thorough hearing evaluation is essential, and hearing will need to continue to be monitored during treatment.
- There are also high-tech tests that can support the diagnosis or monitor treatment. These include tests that directly monitor the electrical output of the organs and nerves of the inner ear when they're triggered by sounds or nearby reflex muscle contractions.

## Treatment and Prognosis

- There are several treatment options for Ménière's disease, though none is really ideal. The main first therapy is dietary—restricting sodium—sometimes along with taking a diuretic to reduce body water. This simple treatment can reduce vertigo attacks but may not effectively slow hearing loss.
- Medications can be used during acute attacks to reduce the uncomfortable sensations of vertigo and nausea, but these don't reduce hearing loss, and they are also ineffective in preventing further attacks. Still, conservative management and monitoring of hearing is probably good enough therapy for many people with Ménière's disease.
- Another option for treatment is the use of steroids, which may reduce the pressure in the endolymph fluid. These can be given orally, by injection, or even by injection through the eardrum into the middle ear. There are some serious potential side effects of steroid use, especially if they're needed for a long course.
- More aggressive therapy, especially for frequent and severe vertigo attacks, can include direct injections of medicine into the middle ear. An antibiotic called gentamicin is used—not because it is an antibiotic, but because it can decrease the number of **vestibular** hair cells that are sending the incorrect balance information to the brain. Although it can effectively reduce or eliminate vertigo attacks, gentamicin can actually make the hearing loss worse, so this therapy isn't suitable for everyone.
- There are some surgical options for therapy as well. A shunt can be placed in the inner ear to drain some of the excess fluid; however, how well this works is controversial. This kind of surgery is nondestructive and can at least theoretically preserve hearing.

- Another surgical technique is to divide and destroy part of the vestibular nerve. This can achieve good control of vertigo in most patients, and usually hearing is preserved, but it is irreversible.
- The most aggressive approach of all is to remove the entire labyrinth on one side, permanently stopping symptoms of vertigo and tinnitus from one ear, but also eliminating hearing from that side. This may still be appropriate for patients with severe unilateral disease, especially if hearing is already severely affected.
- However, loss of the balance sense can affect gait in many patients, and about 30 percent of patients with unilateral disease will later develop Ménière's disease in the other ear.
- Ménière's disease is often characterized by fluctuating symptoms, with remissions and exacerbations, so it's difficult to predict the long-term prognosis. In most patients, the vertigo attacks subside within 10 to 20 years, and hearing loss remains in the moderate range.

### Important Terms

**ENT:** A surgical specialty standing for “ear, nose, and throat”—sometimes referred to as otorhinolaryngology.

**hypoglycemia:** Low blood sugar concentration. Contrast with hyperglycemia (high blood sugar) or euglycemia (normal blood sugar.)

**lesion:** A region of an organ or tissue that has been damaged.

**nystagmus:** A rapid, flicking movement of the eyes.

**vertigo:** A spinning sensation, or feeling that one's environment is spinning around.

**vestibular:** Related to the sense of balance and position sense.

## Suggested Reading

Kapit, *The Physiology Coloring Book*.

Meniere Man, *The Self Help Book for Meniere's Disease*.

Vestibular Disorders Association, <http://vestibular.org/>.

## Questions to Consider

1. What organ systems, when not working properly, can cause a feeling of dizziness?
2. Are there risks to having a CT scan?

# Weight Loss

## Lecture 10

In some ways, we've made great strides against diabetes. We understand far more about the physiology of both type 1 and type 2 diabetes, and we have the tools to aggressively keep blood sugars normal. We've also gotten much better at treating the complications of diabetes. However, we haven't really been able to make any strides in preventing diabetes in the first place, and the vastly increasing number of diagnoses of diabetes has dwarfed the advances to identify and treat diabetes.

### A Scheduled Checkup

- In the general internal medicine clinic, a 46-year-old woman named Charlene comes in for a scheduled checkup. When asked what's on her mind, she says, "I feel fine." Charlene is either 1) perfectly healthy or 2) has something wrong with her that she hasn't noticed yet, or at least hasn't told us about yet.
- Charlene is 5 feet and 4 inches tall and weighs 180 pounds, which corresponds to a body mass index of 31, which is in the overweight or obese zone. You bring that up, in order to encourage improved diet and exercise habits. Charlene responds, "Actually, that's pretty good. I think I've lost a lot of weight this past year."
- You take a brief lifestyle history, then of diet and exercise habits, and are left with an *unexplained* 30-pound weight loss. That's a problem. Significant weight loss without effort means something is wrong.
- Moving on to labs and tests, markers of inflammation like a sed rate are normal, and the CBC is also normal. With no signs of infection, inflammation, or anemia on these simple tests, whole categories of disease have become unlikely—there's very little chance of cancer, inflammatory bowel disease, or chronic infection. A chemistry profile shows no liver disease and normal kidney function.

- But the blood glucose from the chemistry panel is high at 210. Though the range of normal glucose is wide and depends on when the last meal was eaten, blood glucose level in an adult should almost always be less than 180 and is usually less than 140. How would a high blood glucose cause weight loss? The hint will be in the urine.
- An ordinary, in-office urinalysis is done using a dipstick—a thin strip of plastic with little pads glued onto it. Each pad contains chemicals that change color when they react to different things in the urine. One pad will turn darker if there are red blood cells and another for **white blood cells**; one will change color if there are urine chemicals that are produced by bacteria, indicating a possible urine infection.
- On Charlene's urine dipstick, one pad lit up—the one for glucose. She's spilling a lot of sugar into her urine and may have been doing this all year. This can cause weight loss.
- Normally, the kidneys filter out glucose, so there is none in the urine at all. If blood sugar concentrations are high enough, as they are in Charlene, some of the sugar will spill out into the urine.
- There are no immediate symptoms of this, but in time, that lost sugar is equivalent, in a way, to being on a diet (though not a healthy one). People who spill sugar into their urine may be losing the equivalent of 400 to 500 calories each day. As dieters know, that's a big number, and unless you consistently eat extra to make that up, you will lose weight.
- With increased blood sugar and sugar in the urine, we can diagnose Charlene with diabetes, specifically diabetes mellitus.

### Diabetes Mellitus

- The term “diabetes” comes from a Greek word referring to a siphon or something that passes a great deal of water. The term “mellitus” refers to the sweet taste of the urine, as if it is sweetened with

honey. In 1776, the glucose concentration of the urine of diabetic patients was first measured, confirming the central role of so-called **glucosuria**—glucose in the urine—as a defining feature of diabetes.

- Understanding diabetes means understanding glucose and carbohydrate metabolism and how altered glucose metabolism causes illness. All foods contain one or more of the three so-called macronutrients—the common molecules that we eat and absorb for energy. These three macronutrients are carbohydrates, fat, and protein.
- Carbohydrates are further divided into the simple sugars—small molecules of one or two sugar units each—and complex sugars, also called polysaccharides, which are essentially chains of smaller sugar units linked together. Polysaccharides are commonly called starches, and in the gut, these long carbohydrates and smaller two-unit carbohydrates are chopped into single simple sugar units called monosaccharides for absorption. The main monosaccharide absorbed from food is glucose, and for practical purposes, the terms “blood glucose” and “blood sugar” refer to the same thing.
- Glucose is crucial at many levels of metabolism. It is the essential energy source for many body tissues and can be converted to a variety of forms, including the building blocks of fat, by processes in the liver. The level of blood sugar is tightly controlled by several overlapping homeostatic mechanisms to ensure good health and energy availability.
- The word “**homeostasis**” is a central way that living organisms maintain health. Homeostasis is an active process that regulates the internal environment, keeping essential parameters like pH, temperature, electrolytes, and metabolic substrates all in a normal range. Once homeostasis is disturbed, all sorts of problems ensue.
- Diabetes comes in two types. Type 1 diabetes used to be called juvenile diabetes, and though it usually occurs in children, it can begin in adulthood. In type 1 diabetes, the beta cells of the pancreas

are destroyed by the body's own immune system, eliminating the body's ability to secrete insulin. This condition had been uniformly and rapidly fatal prior to the development of insulin injections in the 1920s.

- In contrast to type 1 diabetes, type 2 diabetes more commonly begins in adulthood, usually in people who are overweight. Although the exact mechanisms aren't completely understood, many overweight people will eventually seem to develop resistance to insulin; even though their pancreas can produce plenty of it, the circulating insulin becomes ineffective in driving down blood sugar.
- Eventually, in type 2 diabetes, there is decreased insulin secretion as well (though insulin isn't typically completely gone, as it is in type 1 diabetes). The combination of insulin resistance and relative insulin insufficiency leads to high blood sugar, or hyperglycemia, in type 2 diabetes. And it's the hyperglycemia that causes most of the mischief.
- Although they can be life threatening, acute complications of high blood sugar are not very common in type 2 diabetics. The main goals of therapy are to prevent the very significant, late effects of long-term hyperglycemia. These late effects can affect almost every organ system of the body. Although treatment and good control of blood sugar will prevent or delay most of these complications, even with very good therapy, patients with diabetes remain at risk.
- These complications of diabetes include the following.
  - Heart disease, including an increased risk of heart attack and stiffening of the heart wall, leading to chronic heart failure
  - Other arterial disease, which can cause stroke or a loss of circulation in the extremities that may lead to amputation
  - Kidney disease – in fact diabetes is the most common cause of kidney failure in the developed world;



- **Neuropathy**, or nerve damage, that can lead to abnormal or decreased sensation or weakness
- **Retinopathy**, or eye damage—this can cause severe vision loss or blindness
- There is also an increased risk of dementia, chronic lung disease, frequent infections, and skin ulcers. All of these complications develop after many years of disease, typically 10-20 years, though there's quite a bit of variability. Though better glucose control decreases the likelihood of complications, it is difficult to predict which patients remain at the most risk.

### Treatment and Weight Control

- The treatment of diabetes is primarily concerned with achieving euglycemia—that is, a normal blood sugar during, after, and between meals. In type 2 diabetes, first-line therapy is losing weight and improving exercise habits. Sometimes, these steps alone can be sufficient to essentially “cure” diabetes.
- More typically, though, medications are necessary. These include oral medicines—so-called oral hypoglycemics—that increase insulin sensitivity, increase insulin release, or both.
- In many patients with type 2 diabetes, insulin must also be administered, typically by one or more daily injections. Type 1 diabetics, who lack any of their own insulin, must rely on injections. The treatment of diabetes also requires frequent home glucose monitoring with finger sticks.



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**Some diabetics need to be injected with insulin because their pancreases don't secrete it.**

- A more advanced treatment strategy, more typically used for type 1 diabetics, is an insulin pump to administer a constant flow of insulin to the body, similar to the way a healthy pancreas secretes insulin. There's also technology available to continuously monitor blood sugar.
- Though tight control—that is, using intensive therapy to keep blood sugar close to normal—has been shown to best prevent the long-term complications of diabetes, it comes at a price. Deciding how tightly to control blood sugar depends on such factors as the life expectancy of the patient, the overall health and other risk factors, and an honest assessment of compliance and a patient's ability to self-medicate.
- With the exception of a few patients with new-onset type 2 diabetes who successfully lose weight and improve their exercise habits, most patients with diabetes require lifelong active management.
- Diabetes is a good example of a disease whose treatment requires not just taking pills and visiting the doctor, but also taking charge of your health and making changes in your life.
- Effective weight control involves primarily changing the diet to consume fewer calories. Many different styles of diet have been proposed and studied, including ones that especially discourage carbohydrates or that stress consuming more foods with lower energy content. The best predictor of success isn't which diet is followed, but whether changes in habits can be sustained for years.
- Although exercise alone is usually ineffective in leading to weight loss, exercise combined with dietary changes works better than diet alone. Medications can sometimes be an additional part of a weight-loss program, but none are really ideal or particularly effective.
- Objectively, the most effective therapy for weight loss for obese patients is surgery. This is a fast-growing field called bariatrics, and it involves a variety of surgical options to lower the stomach

volume or bypass some of the digestive and absorptive parts of the intestine—or both.

- Although the results of **bariatric surgery** can be impressive, surgery will not be successful without the patient committing and following through with lifestyle changes as well. Bariatric surgery also entails considerable risks, so it's really only offered to people with severe obesity or who are already suffering from health consequences of their weight.

### Important Terms

**bariatric surgery:** Surgery intended to assist weight loss.

**glucosuria:** Glucose in the urine.

**homeostasis:** Physiologic equilibrium, as maintained by mechanisms that control vital processes.

**neuropathy:** Damage or malfunction of nerves.

**white blood cells:** The cells in the blood that are part of the immune system.

### Suggested Reading

Pollan, *Food Rules*.

American Diabetes Association, <http://www.diabetes.org/>.

### Questions to Consider

1. Who is responsible for making sure that prior records are available and reviewed—the doctor or the patient?
2. What kinds of illnesses can cause unexpected and unhealthy weight loss?

# I Can't Walk

## Lecture 11

**I**nfluenza is the preventable cause of death of 35,000 Americans each year. It's an old disease that has been thought to be caused by astrological influences or by cold air at various times. Despite some of the myths about flu vaccines, they are safe, and although they are far from perfect, they are one of the best ways we have to fight infection. Yearly influenza vaccination is recommended for everyone over six months of age, and the years it works best are the years when more people get the vaccine.

### Subacute Leg Pain

- A 19-year-old man is brought to the emergency department. His name is Christopher, and his chief complaint is: "Doc, I can't walk." He says that for the past two days, his legs have been hurting very badly, and it's getting worse. The pain is mostly in his calves. As long as he doesn't try to move much, it's okay, but if he stands or stretches out his legs or feet, the pain becomes much worse.
- This is an unusual presenting symptom; we need more history. He can't recall exactly when it started but says that he noticed the pain when he awoke two days ago. He's had no recent injury, and he hasn't exercised much lately. He says he's in great shape, though. He usually exercises a lot, just not in the past two weeks.
- The physical exam confirms that he has tender calf muscles and a lot of pain with stretching. This is some kind of muscle disease that is primarily affecting his calves. A general term for muscle inflammation is **myositis**. Pain and **tenderness** are inflammatory signs.
- Myositis can also occur as part of autoimmune disease, when the body's immune system attacks its own tissues. Rheumatological disease can include myositis among other manifestations.

- Primary infection in muscle itself isn't common, and it would be kind of unusual to have muscles in both legs get infected at the same time. Influenza can cause muscle aches both during and sometimes for several days after the main symptoms of infection.
- Christopher had a recent fever illness and was quite ill. In fact, this case took place in February, during flu season. Influenza is a likely diagnosis that fits the history and physical exam.
- We do a quick test for influenza virus on a nasal swab, which is positive. These rapid tests are widely available in hospitals and doctors' offices and can be done in a few minutes. The current tests are very specific for influenza—meaning that a positive test is quite reliable.
- However, they're not very sensitive. A negative rapid influenza test may be false, missing maybe 20 to 30 percent or more of people who truly have the flu. The exact accuracy depends on what kinds of flu virus are circulating.
- Influenza-associated myositis is common, especially in children, and it occurs toward the end of the fever or a few days later. It most typically affects the calf muscles, though sometimes other muscles hurt, too. They'll hurt to move, and they'll be tender to touch.
- Often, the urine will be dark, and if you do blood tests, you can see the high CPK values. Urine will show the passing of muscle proteins, the myoglobins, by testing positive for blood but negative for red blood cells.
- The treatment is supportive: pain medicine and extra fluids to keep urine flowing. Rarely, this can progress to severe muscle breakdown and resulting kidney damage. Although there are anti-influenza medicines available, myositis usually begins later, beyond the time when these medicines can help. Symptoms of influenza myositis typically last about a week.

## Influenza

- Influenza strikes millions of Americans each year and remains a very significant cause of death, directly killing about 35,000 in the United States each year and probably contributing to the ill health and decline of many more, especially elderly adults.
- Influenza is more common in the winter—in the cold months. This may be because people congregate indoors, passing their germs around more efficiently, or perhaps in part because damage to the lining of the nose by cold air makes it easier to catch influenza (and other viruses as well).
- The typical course of influenza begins with exposure to the virus, followed by a brief incubation period of one to four days. People become contagious the day before symptoms begin. Symptoms are typically sudden and include fever and aches and chills, often with some respiratory symptoms, such as cough and runny nose, and sometimes with GI symptoms, including nausea and vomiting. The disease typically lasts about five to seven days.
- Many people mistakenly think that influenza is just a bad cold, but it really is a distinct, different disease, caused by the specific influenza virus. Influenza causes much higher fevers, plus characteristic body aches that aren't seen with ordinary colds.
- The treatment of most cases of influenza is mostly supportive. Medicines like acetaminophen or ibuprofen—more widely known by their brand names, Tylenol or Advil or Motrin—will help reduce fevers and relieve the aching feelings. Extra fluids are also needed during fevers to prevent dehydration. Rest, stay away from other people, and stay in bed until you feel well.
- There are medicines that can be used to specifically fight the flu. The most widely prescribed one is oseltamivir, which is sold as the brand Tamiflu. It can help some, but it's no wonder drug. It works best when started very early in the infection, within 48 hours—or, better yet, within 24. After that, it doesn't help much. It can

modestly reduce symptoms and the duration of the infection, but it's not overall very effective in reducing serious complications.

- It is the complications of influenza that we fear. Myositis, like Christopher experienced, can be painful and even debilitating, but with supportive care, full recovery is expected. The most serious complication of influenza, which contributes to most of the deaths, is pneumonia.
- We've talked about pneumonia some before, but it's such a common condition both as a primary infection and as a complication of other illnesses that we ought to cover it more thoroughly. Pneumonia comes from the Greek, meaning inflammation of the lungs; the word is probably related to older root words that refer to fluid or flowing in the chest. Even the ancients knew that fluid in the lungs, leading to a wet cough, wasn't a good thing.

### **Influenza Pneumonia**

- Pneumonia is commonly understood as a bacterial infection in the lungs, but it can be caused by viral or fungal or other kinds of infections, or sometimes by noninfectious things like chemical irritants or an immune-mediated inflammatory reaction.
- In most circumstances, though, pneumonia is caused by infection of the lung tissue—infection that causes an accumulation of fluid and debris that leads to coughing and fever.
- Lung tissue itself is particularly prone to infection, because we're constantly breathing in air and bringing in whatever we breathe. Also, the air sacs in the lungs are normally a little moist, and that warm, moist mucus is a breeding ground for microorganisms.
- Fortunately, we have immune systems to keep infection away. There are also little hair cells that beat up and down to keep mucus moving around and out so that it won't get infected easily. But advancing age, lung damage from mild infections, asthma, and

many other conditions can compromise lung integrity, increasing the risk of pneumonia.

- Influenza, the infection itself, causes fever and cough, so how can we tell it has turned into pneumonia? The time course of the symptoms is a crucial clue. Influenza usually includes about five days of fever that gradually decline. Increasing fevers after a few days often indicates a second, superimposed infection like pneumonia. Cough that's getting much worse is another clue.
- On the physical exam, a patient with pneumonia—influenza pneumonia or any pneumonia—will often be breathing rapidly. There may be signs of increased difficulty breathing, such as pulling in the ribs with each breath, and the breath sounds themselves heard through a stethoscope will sound crackly and abnormal.

- Sometimes, a chest X-ray is done to confirm pneumonia. It will show an area of brightness where the X-ray beam is blocked by the accumulated infected fluid. The bigger the area of brightness, the worse the pneumonia (though there isn't a 100 percent correlation).



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- X-rays can also be done to monitor therapy for pneumonia to ensure improvement. However, chest X-rays aren't perfect. The findings on the film can lag a day or so behind what's going on with the patient, so very early pneumonias may not be seen yet.
- Although pneumonia in young, healthy patients can usually be treated as an outpatient, in older or ill people, it may require hospitalization and extra support with oxygen. Pneumonia remains a

**From a chest X-ray, a doctor can diagnose pneumonia, a disease of the lungs.**



significant cause of death in the developed world, often contributing to illness and decline in people with other health problems but occasionally killing someone who was otherwise well.

- In the case of influenza pneumonia, the secondary pneumonia itself can be caused by the flu virus invading the lung tissue or by secondary bacterial infections by bacteria that happened to be nearby and have taken advantage of the patient's illness to cause another infection.

### **The Flu: Prevention and Myths**

- To prevent influenza, most importantly, stay away from sick people during flu season—typically in the winter, from December to March. If you're sick, especially with fever, stay home. Influenza virus can spray in the air through coughs and sneezes, but it usually gets into your system through your own hands. If you keep your hands away from your face, and wash or sanitize your hands frequently, you'll keep most influenza infections away.
- Immunization is also crucial. The currently available vaccines aren't perfect. The protection varies from year to year; from perhaps 40 to 80 percent protection is expected, depending on circulating strains. But even in poorly matched years, the vaccine provides at least some protection, and the more people get the vaccine, the more protected all of us will be.
- There are some persistent myths about the flu vaccine. First of all, the vaccine cannot give anyone the flu. You can get some achiness and fever, which happens in one to two percent of vaccine recipients, but that is not the flu.
- Some people are under the impression that they "got the flu" from the vaccine, either because of mild side effects or because they indeed got the flu or some other illness right after getting the vaccine. After all, the vaccine is given right during flu season, and it takes about three weeks to work—so if you're exposed to the flu

within a few weeks of the vaccine, you're going to get the disease, and it's not the fault of the vaccination.

### Important Terms

**myositis:** Inflammation of muscle.

**tenderness:** Pain that is increased with palpation.

### Suggested Reading

Barry, *The Great Influenza*.

Plotkin, et al, eds, *Vaccines*.

Centers for Disease Control (CDC), <http://www.cdc.gov/flu/>.

### Questions to Consider

1. Why are viral respiratory infections, such as influenza and the common cold, more common in the winter?
2. A good diet can help maintain health. Are there popular diets that contribute to ill health? How?

# Learning from Failure

## Lecture 12

One of the most important goals of discussing cases is to learn from the mistakes of others, so that the mistakes don't have to be made again and again. Poor communication among a patient's doctors can lead to a prolonged diagnostic journey, including multiple doctors, a whole lot of tests, and—most importantly—a significant delay in helping the patient. For good patient care, it is essential for doctors to communicate well with patients, for patients to communicate well with doctors, and for doctors to communicate well with each other.

### Persistent Itching

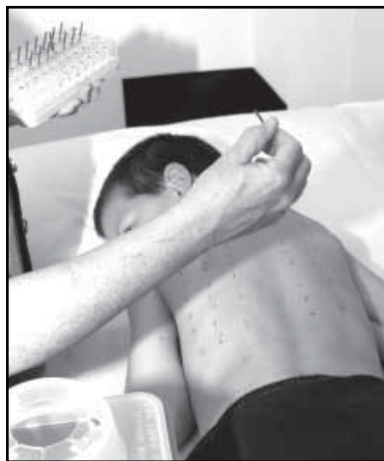
- Leslie, a new patient to the general adult medicine clinic, is a 45-year-old woman with a chief complaint of “I’m tired of the itching.” She has brought a voluminous stack of prior medical records that is loaded with lab reports and letters from specialists.
- Leslie says that she had been in good health until about nine months ago, when she started to develop itchy rashes. The rashes appear and disappear quickly, within an hour or so, and they’re always itchy. If they pop up at night, they interfere with sleep; if they occur during the day, they interfere with work.
- Leslie says that she’s seen doctor after doctor and knows she’s allergic to certain foods. She’s tired of taking all of the medicines that she’s been prescribed, and she’s sick of doctors, labs, and tests. She seems very frustrated.
- Having recurrent hives with no identified trigger persisting for a long time, Leslie’s diagnosis is chronic **idiopathic** urticaria, a condition that is not uncommon and can lead to significant disruption and very distressing symptoms. In fact, she was diagnosed with chronic idiopathic urticaria by two allergists and a dermatologist, but it was never communicated clearly to Leslie.

- Leslie's story teaches us a number of lessons.
  - When a patient is offering a confusing story, the doctor shouldn't settle for yes/no answers.
  - Insist on clear instructions. When you see a doctor, you need clear instructions on what to do; when you're the doctor, you must make sure that your patient understands you, even if that means writing things down. In fact, it should always mean writing things down, which means including both brand and **generic** names and avoiding using doctor abbreviations that some people might not know.
  - The more doctors involved, the more the patient has to insist on clarity. One of the confusing things with Leslie is that multiple doctors were prescribing multiple things and ordering multiple tests. Everyone was making mistakes, and—more importantly—nobody was learning anything from anyone else's mistakes. When one medicine was tried but didn't work, the next doctor didn't know that and maybe even tried the same medicine again.
  - A medical encounter should always address the primary concerns of the patient. Our patient's concern is a recurring, itchy rash, but she was sent to the endocrinologist because someone thought that she had thyroid disease. There were two main issues that the endocrinologist should have addressed: the rash and the thyroid tests. From our patient's point of view, she didn't get clear feedback about either of these issues.
  - Beware when the diagnosis or plan doesn't make sense. This goes for doctors and patients. As a doctor, if you can't explain the working diagnosis and plan clearly, it's probably because it's not clear in your own mind. You need to think more. From the patient's point of view, if you don't understand the diagnosis and plan, you need to speak up and ask—and ask again.

- Treating the disease is not the same as treating the patient. Our patient wanted relief from a recurring, itchy rash; she didn't want to have a bunch of blood tests and see a bunch of specialists. All of these tests unfortunately led to doctors focusing on the test, not on the patient herself. In fact, the side effect of all of these tests—the worry and distraction and expense—may have been almost as bad as the itchy rash itself.
- Whether to do a test depends on both how likely it is that the patient has the disease that you're looking for and on how accurate the test is. Less accurate tests should be done only when absolutely indicated, or they're going to lead to mischief. In any case, tests should only be done if the result of the test will be useful; if the result isn't going to change the plan, then the test shouldn't have been done in the first place.

## Allergy Tests

- In general, there are two kinds of allergy tests: blood tests and skin tests. Blood allergy testing is often preferred by **general practitioners** and non-allergists, because anyone can order it and draw blood. These kinds of tests will also not be affected by allergy medicines that patients are often taking.
- The older generation of allergy blood tests were based on **IgG** antibodies and are worthless. These IgG-based tests should never be done, though they're still offered by some less mainstream labs and doctors. The newer tests, based on



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**One type of allergy test is a blood test, which can have false positives, so the results should be confirmed.**

**IgE** molecules, are more accurate. But even the best of these blood tests can still be misleading.

- Skin testing is more often performed by allergists, because it can be done in their offices with results available the same day. The results can be affected by certain medications.
- The bottom line for both skin and even the best blood testing is that these tests have many false positives and can have false negatives, too. They can be helpful to get a clue about what exposures could be triggering an allergy but should be confirmed before declaring that a patient is actually allergic.
- Allergies are immune-mediated reactions to exposures to environmental things, including foods, pollen, and dust. Very characteristically, allergic symptoms occur very shortly after exposures, and they're stereotyped—meaning that the reaction is the same every time, after the same exposure. This is especially true for food allergies, which usually trigger reactions within minutes or maybe an hour after ingestion.
- Typical reactions to food allergies include reactions in the skin, such as hives or swelling. It can also include GI symptoms, such as vomiting, diarrhea, or crampy pain; or difficulty breathing or cough. Severe reactions can lead to low blood pressure and loss of consciousness. These usually occur very quickly after the food trigger is eaten.

### Urticaria

- There are a few conditions that can kind of mimic chronic idiopathic urticaria, but it's easy enough to tell the difference. Allergic contact dermatitis occurs only where a contact allergen touches the skin, so it's in the same place every time. A so-called fixed drug eruption can be a recurring swollen area, but it's in the same place every time, and as it heals, it leaves a dusky area.

- The only rash that occurs like Leslie's, popping up quickly anywhere on the body and then disappearing quickly, is urticaria.
- At least 30 to 50 percent of chronic idiopathic urticaria is autoimmune—that is, there are antibodies against our own tissues that trigger the reaction. It's likely that perhaps the other 50 percent is autoimmune, too, but we haven't been able to test for the antibodies yet. So perhaps that term “idiopathic,” meaning “of unknown cause,” is misleading.
- Food allergies can cause acute episodes of urticaria, but it's very unlikely that foods will cause longstanding, chronic urticaria without clear correlation. Some people with chronic urticaria can have hives triggered by physical things, such as pressure on the skin, warmth, or cold. These triggers are usually clear from the history.
- Many patients with chronic urticaria, like Leslie, have thyroid antibodies, but these don't seem to be the actual trigger. Usually, thyroid functioning is normal, and these antibodies require no treatment. Even if thyroid functioning is abnormal, treating the thyroid condition doesn't help resolve the urticaria.
- There is good therapy available for chronic idiopathic urticaria. It's crucial that patients are taught how to use the medicines correctly. Daily use of antihistamines at relatively high doses, every day, can help suppress the rash. It's important that these antihistamines not be stopped on days when the rash is absent—staying on them daily, long term, even on days without rash, helps keep the rash suppressed. Sometimes, multiple antihistamines that work via different receptors are used simultaneously.
- If maximal, regular, scheduled use of antihistamines is ineffective, daily or every-other-day oral steroids can be used, though side effects of this strategy can be significant. To avoid long-term steroids, other immune-modifying medications, such as cyclosporine, can be useful. Even more aggressive strategies can include the administration of intravenous immunoglobulin or

**plasmapheresis**, a method of filtering out immune molecules from the blood.

- Ironically, Leslie was prescribed the correct medications, but because multiple doctors had given her different instructions, she didn't understand how to use these medications correctly. In our clinic, no further tests were done, and written instructions were provided for the use of two simultaneous antihistamines.
- Leslie, as is typical for most people with chronic urticaria, did not have any food allergies, but food allergies are a significant problem for many people, and they're often misunderstood. It's important to make a distinction between an adverse reaction to food—something like the bloating and diarrhea that goes with lactose intolerance—and a true food allergy, because only real food allergies can progress to life-threatening reactions.
- Most food allergies cause only mild symptoms. The best predictor of who is at risk for serious food reactions is what has happened with that food exposure in the past. Anyone who has had a life-threatening or severe reaction to a specific food is at risk for that happening again.
- Also, some foods, especially peanuts and tree nuts, are more likely to cause more severe reactions than other food allergens. In addition, any person who has a history of asthma or recurrent **wheezing** who also has food allergies is more likely to experience a severe reaction to foods. These are generalities. If you have food allergies or a suspicion of food allergies, work with your own doctor for specific recommendations.



## Important Terms

**general practitioner:** A physician who treats general conditions; this title does not require a residency or board certification.

**generic:** Referring to medications, “generic” means manufactured by a company that does not own the patent.

**idiopathic:** Of unknown cause.

**IgE:** Immunoglobulin E, a specific subtype of antibody that’s often associated with allergic disease.

**IgG:** Immunoglobulin G, the most common subtype of antibody circulating in blood.

**plasmapheresis:** A medical procedure that separates out the plasma from the whole blood and then filters out certain elements, typically proteins, before returning the blood to the body.

**wheezing:** A physical exam finding of the lungs, heard best with a stethoscope. Wheezing sounds like air rushing through small tubes and is most typically heard in expiration.

## Suggested Reading

Montgomery, *How Doctors Think*.

Wanderer, *Hives*.

## Questions to Consider

1. Do you think doctors learn more from their successes or their mistakes?
2. What is the difference between treating a disease and treating a patient?

# The Children Who Come and Go

## Lecture 13

**S**ickle-cell anemia is an ancient illness. Although it was “discovered” about 100 years ago, it’s clear that this disease has afflicted people since ancient times. Although we will probably never know for sure, it’s quite possible that this disease caused the death of the king of Egypt, King Tutankhamen, at age 19, about 1300 years before the Common Era. The case presented in this lecture teaches you why patients with sickle-cell anemia become ill and what kinds of therapies can be used to keep them well.

### A Pale, Weak Baby

- A 7-month-old boy named Marcus has been brought by his parents to the pediatric clinic. In their words, “He looks weak.” They say that Marcus is a happy baby, but he has never been as active as his sister. Lately, though, he seems more fussy at times and isn’t interested in sitting up or playing much. In addition, Marcus was anemic last month.
- From the physical exam, we find that Marcus is pale and listless. His eyes are yellow, and his heart rate is fast. He also has a **murmur** and a large spleen. We’ve already been told that he was anemic one month ago, and he was started on extra iron. Anemia can cause a high heart rate, and when severe, it can cause low energy or listlessness.
- From the history and physical, Marcus seems to have a chronic, ongoing, anemia caused by hemolysis, or the destruction of red blood cells in the blood. Under a microscope, we can examine Marcus’s cells. Normal red blood cells are round and flat, sort of like fat pancakes with dimples on both sides. Marcus’s red blood cells look very different from each other. Some look normal; some look very small and bent; and many of them have an elongated, crescent shape. Marcus has sickle-cell anemia.



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**Sickle-cell anemia is a blood disorder that can cause tissue damage.**

- Marcus's diagnosis of sickle-cell anemia is confirmed by a test called a hemoglobin electrophoresis, which can confirm the kind of protein that makes up his **hemoglobin**. It's likely that his anemia had been worsened to some degree because he had never had folate supplements but also because he had a mild viral infection that suppressed his marrow.
- After stabilization with several small blood transfusions, Marcus perked up well. There was no evidence of any neurological or cardiac damage. After extensive education for his family, he was sent home on oral folate supplements and oral penicillin to take every day. He will continue follow-up with the sickle-cell center, a multidisciplinary clinic for patients of all ages with sickle-cell anemia and related chronic anemias, as well as with his pediatrician for routine care.

## Sickle-Cell Anemia

- Sickle-cell anemia, which is also called sickle-cell disease, had several earlier names that remain quite telling. Hospitalizations for this disease were sometimes called “muscular rheumatism,” referring to the intense pain that can occur, or “bilious attacks,” referring to both the pain and the **jaundice** (which was also known to be caused by disorders of the bile).
- In 1949, Linus Pauling demonstrated that sickle-cell disease was caused by an abnormality in the hemoglobin molecule; this was actually the first time a genetic disease was linked to abnormalities in the production of a specific protein. Since then, we’ve been able to map the exact gene, find the exact incorrect instruction, and see how that leads to the production of a protein that doesn’t work the way it should. This really was a milestone in the field that was to become molecular biology.
- The genetics of sickle-cell anemia, and the way the genes affect the proteins, is a wonderful lesson to teach both medical genetics and the practical impact of evolution on health.
- Each of us has two copies of each gene (except that men have only one X chromosome and one Y chromosome—all of the other chromosomes come in pairs). One gene comes from our mother and one from our father. Each gene is a string of DNA that gives instructions for making a protein.
- The normal hemoglobin in adults is called hemoglobin A, and most of us have two copies of the gene that makes that normal hemoglobin. In sickle-cell anemia, both copies of this gene are broken; one of the base pairs of the DNA instructions is wrong, so the cell making the hemoglobin molecule substitutes one incorrect amino acid into the chain that makes the protein. That one substitution—just one wrong amino acid—causes the hemoglobin to form rigid polymers that get stuck in a sickle shape, deforming red cells and making them stiff.

- Sickle-cell disease is a classic so-called recessive condition—to have the disease, you have to inherit both abnormal genes from both of your parents. If you only inherit one abnormal gene and one normal gene, you are what's called a sickle-cell carrier, which causes minimal if any health effects.
- In fact, carriers of sickle cell—people with one abnormal gene and one normal hemoglobin gene—have a genetic advantage. Their red blood cells are relatively resistant to infection with malaria.
- People who are most likely to have sickle-cell disease are from areas of the world with the most malaria, especially Africa. In those communities, malaria was and continues to be a huge health problem; malaria continues to cause about a million deaths, worldwide, each year.
- A genetic mutation that confers some protection from this very common infection would confer increased survival, which allows people who carry the trait an increased chance of having more children to pass on this trait. As evolutionary theory predicts, a genetic mutation that confers a survival advantage will spread and become more common in a community, which is exactly what has happened.
- All of the various manifestations of sickle-cell anemia are caused by a single genetic change that leads to a substitution of one amino acid unit in the hemoglobin molecule. This one substitution creates a hemoglobin that can become sticky and stiff, and that one change leads to infections, strokes, pain crises, anemia, chronic jaundice, gallbladder disease, impotence, leg ulcers, heart damage, and eye problems.

## **Treatment**

- The treatment of sickle-cell anemia starts, most importantly, with the early identification of affected babies. Every state in the United States screens for sickle-cell anemia in all newborns.

- As soon as sickle-cell anemia is diagnosed, these babies are started on an extra folate supplement as well as a daily antibiotic to prevent overwhelming infection. These early interventions have dramatically reduced the early mortality of the disease. Thirty years ago, prior to these recommendations, fewer than half of people with sickle-cell anemia lived to reach adulthood.
- It's also crucial that routine vaccines are received because those can prevent some of these bacterial infections, and families also need to be taught how to recognize early symptoms of infection and get immediate care.
- Families need to learn how to prevent crises and complications and when to seek immediate care. For example, dehydration and situations with low oxygen need to be avoided.
- Depending on the severity of the disease, other treatments may be needed. Patients who are having strokes, frequent pain, or chest crises can be given routine transfusions to keep their anemia under control; by diluting the sickling cells with donated, normal cells, vasoocclusion can be at least partially prevented. Frequent transfusions carry their own risks, but in certain patients, it can be lifesaving.
- Pain crises need to be immediately treated with pain medication, oxygen, and fluids to treat dehydration if present. Sometimes, transfusions are also needed during these and other crises.
- There are also medications that can be used, and more are under development, to suppress the sickle kind of hemoglobin and encourage the marrow to produce a different variety called fetal hemoglobin that would otherwise only be produced in the marrow before birth.
- The most aggressive therapy available for sickle-cell anemia is bone-marrow transplantation, which involves essentially killing off a patient's entire marrow and replacing it with donor marrow

from someone else. This is curative, but it entails a lot of risk and tremendous expense.

- Bone-marrow transplantation will prevent the development of new or further complications of sickle-cell anemia, but it will not be able to reverse the damage from previous strokes or other preexisting complications. Currently, excluding bone-marrow transplantation, sickle-cell anemia cannot be cured. But it can be treated and managed to prevent and mitigate complications.
- Blood transfusions are an important part of therapy for sickle-cell anemia and many other conditions, and the development of modern blood banking has been a huge contributor to extending healthy lives. Good blood banking requires careful, sterile technique for collection and transfer, plus very specific storage systems with tightly controlled temperatures.
- It's also crucial that blood for transfusion be matched, or the recipient can experience a catastrophic immune reaction to the foreign proteins on the red blood cells. Even with careful matching, there is still a risk of blood transfusion reactions, and these can be severe. About 1 in 20,000 to 50,000 transfusions will cause a life-threatening reaction.
- There is also a risk of transmission of disease. Although blood banks screen both donors and blood for many infections, there may be some infections that we do not know how to test for yet, and no test is 100 percent accurate.
- It's estimated that about 1 in 1.5 million transfusions will transmit HIV virus, and 1 in about 300,000 transfusions may transmit hepatitis B. The risk of infection or serious reactions is small enough to be acceptable only if a patient is truly in need of a transfusion.
- For patients with chronic anemias (including sickle-cell anemia, thalassemias, and other conditions), the frequent transfusions become more likely to cause either infections or reactions. In

addition, a risk eventually develops for iron overload, because each transfusion puts extra iron into the body. Hopefully, future therapies will replace the need for blood transfusions for these patients.

### Important Terms

**hemoglobin:** The molecule in red blood cells that binds oxygen. “Hemoglobin” often refers to a quantitative lab measurement of the concentration of this molecule in a blood sample.

**jaundice:** A yellow color to the eyes and skin caused by excessive bilirubin in the blood.

**murmur:** A noise heard over the chest with a stethoscope caused by turbulent blood flow through the heart.

### Suggested Reading

Hillman, et al, eds, *Hematology in Clinical Practice*.

Centers for Disease Control (CDC), <http://www.cdc.gov/ncbddd/sicklecell/index.html>.

### Questions to Consider

1. What sorts of problems make a person look pale?
2. Are there special health considerations to think about for the children of military families?



# Guardians' Day

## Lecture 14

**P**rescription drug abuse is a disease that has affected almost all of our lives in one way or another. It has become a common cause of disrupted lives, lost jobs, and death—striking every age, from teens through elderly adults. We are not, as a whole, doing a particularly good job of tracking prescriptions to identify those at risk, and we're doing a terrible job of getting people who are addicted the addiction treatment they need.

### Constipation

- Our next patient in the general medicine clinic, Sandra, is a 35-year-old woman who we have not met before. Her chief complaint, as listed on the intake form, is “constipation.” According to her, it’s been going on for about a year, maybe longer, but it’s just getting worse and worse. She has brought some of her medicines with her so that you could see what she’s tried.
- Constipation is very, very common, and most of the time, it’s related to lifestyle factors and diet. But it can be part of some important health problems, too. Constipation is often related to several overlapping factors: Basically, anything that either slows down the movement of the gut or leads to dry, hard, firm stools is going to contribute to constipation.
- Normally, as food is digested and absorbed and travels through the gut, water is absorbed through the walls of the large intestine. If gut transit is slowed, more water will be absorbed, leading to firmer, hard, bulky stools—which themselves become more difficult to push through, so they sit even longer, getting even more dry and hard. So anything that either slows the gut or leads to less moisture in the stool is going to be constipating.
- Sandra says that she gets a lot of bellyaches and really has to strain. She says that she’s been trying to eat better and drink water and

prune juice, but she can't really exercise much because of her back, which she injured about six months ago. She's seen an orthopedist who did X-rays and thinks she had a slipped disk. She takes pain medicine and now uses a cane to walk.

- Her past medical history is unremarkable. Upon physical examination, we learn that Sandra's vital signs and reflexes are normal. Her labs come back normal. An MRI is done, and the results show that she does have two discs with a small amount of **herniation**, but neither is pressing on any nerves. Discs like that could possibly be causing some pain, though they're seen incidentally in many people and probably don't cause any symptoms most of the time. There's no problem with the spinal cord itself.
- After talking to Sandra for a while and seeing her in the clinic a few more times, it seems like she is doing some doctor shopping; it's not clear why she changed to our clinic. Eventually, we find out that she was also seeing other doctors at the same time. There were reports of stolen drugs or prescriptions, and she may have been using multiple pharmacies. Any of these can have an innocent explanation, but the pattern of behavior, at least in retrospect, seems suggestive.
- Also, it's unclear exactly how Sandra's original back injury led to such significant pain. Her back injury history was kind of vague, and her sustained discomfort was out of proportion to the injury.
- Our patient's apparent addiction to pain medications also caused her to stop working and led to her no longer living with her daughter. Somehow, her daughter had gone to live with another family member—supposedly just because of Sandra's hurt back. These kinds of negative life consequences are typical of true addiction.
- In addition to addiction, there are other side effects of the use of **narcotics**. One of them is constipation—which is what drove Sandra to our clinic in the first place. They can also cause itching, vomiting and nausea, and dry mouth; they can also cause confusion, sleepiness, or dizziness, and it is not safe to drive while taking these medications.

- However, the most severe symptom, the worst side effect, is respiratory depression. Taking higher doses of any narcotic starts to blunt the automatic drive to breathe. The higher the dose, the slower the breathing, and at a high enough dose, breathing will stop. That is the cause of death in narcotic overdose.
- People seek higher and higher doses to satisfy their cravings, and eventually, the dose is high enough to kill. At this point in the United States, there are more deaths from prescription **opioids** than from cocaine and heroin combined.

### **Prescription Drug Abuse**

- Painkillers are the most often abused prescriptions. It turns out that there are really only three medications that are commonly used to treat pain—or at least three groups of medications, and within each group, they're all similar.
- The first group only contains one medicine: acetaminophen, or Tylenol. It's an effective medicine for mild to moderate pain, with minimal side effects when used correctly. It is not addictive.
- The second group, which also has many brands available over the counter, is the nonsteroidal anti-inflammatory drugs (NSAIDs). The most common ones are ibuprofen and aspirin; there are many others available by prescription. They all work in a very similar way. They are also effective for mild to moderate pain and have no addiction potential, and they're pretty safe. Occasionally, and more often with regular use, they can cause GI upset.
- The problem is that neither of these kinds of medicine, alone, is effective for the most severe pain. For the worst pains, the only effective medicines in general use are narcotics and narcotic derivatives. They're all essentially based on an extract of the poppy plant, the precursor to opium.
- These medications range from morphine to codeine with many in between; the group also includes heroin, which is another opium



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**The abuse of prescription drugs is a serious concern in our overmedicated society.**

derivative. They can all be used to effectively treat even the most severe pain, but all of them are potentially addictive when used inappropriately. When abused, they not only relieve pain, but they also get the user high.

- Still, for the many people who suffer from pain, especially chronic pain, narcotics are essential for providing relief. One of the biggest obstacles for these patients is misunderstanding the nature of drug tolerance, dependence, and addiction. This leads to the frequent undertreatment of pain, which itself, ironically, can actually contribute to the development of addictive behavior.
- To prevent, recognize, and treat addiction, we first have to make sure we understand what's happening physically and psychologically. Tolerance is a normal physiological change, when the body adapts to, or seems to "get used to," a certain dose of a medication, such as an opioid.

- When tolerance develops, the drug becomes less effective at a given dose, and to get the desired effect, the dose will have to be increased. Tolerance is an inevitable, predictable phenomenon that will occur in anyone who regularly uses certain medications.
- Dependence is different. In modern medical contexts, dependence refers to physical changes in the body as we adapt to regularly taking certain drugs. Biochemical changes take place mainly in the brain, as the body gets used to regular doses of these medications—and if the medication is stopped or reduced quickly, physical symptoms of withdrawal will take place.
- Symptoms of opiate or narcotic withdrawal can include sweatiness, agitation, aches, insomnia, cramping, diarrhea, nausea, and vomiting. These can be very unpleasant or severe, but they are not life threatening.
- Other kinds of medication can cause dependence and withdrawal symptoms, including steroids, antidepressants, anxiety medication, and some heart medicines (such as beta-blockers).
- Addiction, the way that doctors use the term, means psychological symptoms like compulsive drug use and craving for drugs. People who are addicted to drugs will continue to seek and use the drug despite worsening physical, social, and mental harm.
- In a sense, while the term “dependence” refers to the physical symptoms of withdrawal, the term “addiction” refers to a maladaptive psychological need to consume a drug. This definition of addiction is also used in other contexts, such as people addicted to gambling, sex, or Internet use.
- People with addiction may or may not have physical dependencies and may or may not suffer from physical withdrawal symptoms, but they will crave and seek the addiction even at the expense of their jobs or relationships, risking arrest and social isolation to satisfy their cravings.

- Another term that's sometimes used is "pseudoaddiction," which is seen only in people with chronic pain that is inadequately treated. These patients are desperate for effective pain relief and very fearful of worsening pains, so they watch the clock closely and may take steps that could be considered to be drug-seeking behaviors, such as filling prescriptions early or hoarding pills.
- The behaviors associated with pseudoaddiction stop completely when the pain itself is adequately treated. The key to treating pseudoaddiction (and preventing it from developing into true addiction) is in treating pain correctly.
- Not all chronic pain patients become addicted to opioids. In fact, the vast majority will never have addictive symptoms. Most, if not all, patients who use narcotics regularly will develop tolerance, physical dependence, and the potential for withdrawal, but that's different from the craving and compulsive drug-seeking behavior seen with addiction.
- Although it is possible, addiction is not a common problem among those treated for pain, and a fear of encouraging addiction should not prevent doctors from treating pain and relieving suffering.
- Although we don't know the exact contribution of genetics, it's definitely true that some people seem to have a higher built-in risk for addiction than others. Beyond that, the most important factor in predicting addiction is the reason the drug is taken. People who take drugs to get high or avoid life (as opposed to people who take medication to treat pain or other medical problems) are much more likely to develop addiction.

### **Prescribing Pain Medication**

- Ironically, doctors are sometimes criticized from both sides of this issue. Doctor and hospital ratings stress how important it is for doctors to treat pain quickly and effectively; at the same time, federal and state agencies monitor doctors' prescribing habits and investigate those who seem to prescribe too many narcotics.

- Judging whether pain is real or exaggerated is very difficult; we don't have any kind of objective "pain meter." Add to that the complexities of the modern American medical system, the multiple doctors and pharmacies, and it's very difficult to identify patients at risk for addiction, especially when they deliberately cover their tracks to hide drug-seeking behavior.
- This is not a good situation, and it's contributing to the suffering of both pain patients who need effective pain treatment and to patients, families, and communities struggling with addiction.

### Important Terms

**hernia:** A condition where an organ protrudes through the wall of the area surrounding it.

**narcotic:** A class of pain relievers derived from opium or morphine.

**opioid:** An opium-like compound, informally synonymous with "narcotic."

### Suggested Reading

Fletcher, *Inside Rehab*.

Sheff, *Beautiful Boy*.

### Questions to Consider

1. What are the best ways to judge how much pain a patient is experiencing?
2. Why do some people who are prescribed painkillers develop addiction while others do not?

# Dickens's Diagnosis

## Lecture 15

**O**besity contributes to more ill health, poor quality of life, and early death than smoking—yet we still don't have a good handle on the best ways to prevent or treat it. Obesity results when someone regularly takes in more calories than needed, but there is far more to the modern obesity epidemic than that. There seem to be neurohormonal and psychological factors, genetic influences, and changes in gut function related to bacterial colonization. Disentangling these factors to come up with comprehensive, workable, and effective ways to prevent and treat obesity is emerging as the health challenge of the 21<sup>st</sup> century.

### Constantly Falling Asleep

- Joe is 55 years old, and he comes to our general medicine clinic with his wife. His chief complaint is: “I fall asleep all the time.” Joe says he's not sure how it happens; he just kind of nods off, and someone has to wake him up.
- There are primary sleep disorders, such as narcolepsy, where control of sleep cycling is disrupted and sudden sleep can occur—especially right after an emotional outburst, such as crying or laughing.
- Or perhaps Joe is just tired; he's not getting enough sleep or enough quality sleep. His sleep could be interrupted by something like sleep **apnea** or restless legs syndrome, both of which can interfere with sleep quality.
- Or maybe he's on some kind of medicine that makes him drowsy. This could be a prescribed medicine, something over the counter, street drugs, or maybe he's consuming too much alcohol. Depression is also a possibility; it can present with excessive sleeping.



- Joe says that he has problems with feeling tired, headaches, shortness of breath with exercise, weight gain, and impotence. He also says that he has swollen feet. He denies smoking or drinking or any substance use; it looks like he hasn't taken any prescriptions or seen any doctors in years.
- On the physical exam, we've found that his resting heart rate is fast (a finding called **tachycardia**), his blood pressure is mildly elevated, and his heart is heaving against his chest. He also has pitting **edema** of his lower extremities, which means that he has puffy skin that you can press into pits.
- The finding of edema means that there is excessive fluid in the spaces between the cells—fluid that is essentially seeped out of the circulation and is just sitting there. This kind of fluid buildup usually occurs from disease of the kidneys, liver, or heart.
- Joe has several indications of heart disease, including edema (with no other explanation), and some kind of issue seems apparent with his lungs or breathing—his blood oxygen is low, and his blood carbon dioxide is high.
- We need more information about lungs and heart. A good test of both is a chest X-ray. On Joe's film, his lungs look fine, but his heart is enlarged. We've found that there is something going on with his heart, and his body isn't getting enough oxygen, and he's not effectively blowing off his carbon dioxide. Heart disease can make you tired, but falling asleep all the time is odd.
- Joe said that he gets enough hours of sleep, though he wakes up still tired. His wife says that he snores, gasps, mutters, snaps awake, and rolls over. In addition, Joe is overweight. His blood oxygen is low, and his blood carbon dioxide is high. Our diagnosis is that Joe has obstructive sleep apnea. And worse, he's now developed complications from that: **congestive heart failure** caused by chronic **hypoventilation**.

## Obesity Hypoventilation Syndrome

- The modern name for the whole package of what Joe has is obesity hypoventilation syndrome, which was first described in the medical literature in 1956 in a case report that named it “Pickwickian syndrome.”
- During sleep, Joe’s upper airway flops closed, causing the snoring and gasping. During these events, blood oxygen falls and blood carbon dioxide rises—because, essentially, Joe stops breathing. He struggles, wakes, and gasps to normalize ventilation, but this is happening so often that his body has trouble compensating and normalizing his ventilation.
- Worse, over time, exposure to high  $\text{CO}_2$  actually blunts the body’s response to the  $\text{CO}_2$ ; essentially, Joe has gotten somewhat used to these ventilatory pauses. In part, this may be from sleep disruption and exhaustion, though there are hormonal changes that occur, too.
- When lung tissue is underoxygenated, the blood flow to those parts of the lungs shuts down. That’s normal physiology, and it makes sense: The body sort of shunts blood to areas of the lungs with more oxygen, and it does this by constricting blood flow to areas with less oxygen.
- If all of the lungs are underoxygenated, the blood vessels throughout both lungs constrict. But the blood has to get through, so the heart has to pump harder and harder. Like any muscle, the heart, when it exercises more, will hypertrophy, or grow larger. This actually diminishes the efficiency of how the heart muscle contracts, forcing the heart muscle itself to need more oxygen, which is becoming less available.
- Joe’s tiredness is from sleep apnea, from frequent interruptions in sleep that are preventing him from getting good rest. His tiredness is compounded by chronic low oxygen and high  $\text{CO}_2$ , which have led to heart failure from what is called pulmonary hypertension—a high resistance to blood flow through the lungs, a physiological



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**A sleep study, which involves hooking a patient up to several monitors while he or she sleeps, can be conducted to determine whether the patient experiences sleep apnea.**

effect of chronic underventilation. The correct medical term is “hypoventilation,” meaning basically breathing less than one should.

- There were a few other things on the review of systems that are also part of the obesity hypoventilation syndrome. These patients have frequent headaches, especially in the morning, perhaps related to poor sleep, poor ventilation, or both.
- Joe also reported a poor ability to exercise, because his heart is already working as hard as it can; if he tries to exercise, there is no cardiac reserve left to pick up the pace. His heart is beating rapidly, and his blood pressure is high—these are part of the neurohormonal response to heart failure, the body trying to get as much blood flow as possible out of a failing heart.
- Erectile dysfunction is also a common complaint of those with sleep apnea and sleep hypoventilation syndrome (as well as other men with heart failure from other reasons).

- The phrase “heart failure” does not mean that the heart has stopped working entirely; instead, it means that the heart’s pumping power is decreased and that it is not delivering enough blood to the body tissues.
- Heart failure can be caused by coronary artery disease that leads to a heart attack, which kills some of the heart muscle; or it can be caused by a problem with a heart valve, so the blood doesn’t flow efficiently in the direction it’s supposed to; or it can be caused by problems with the working of the heart muscle itself, which can occur with severe thyroid disease or muscular dystrophy. Heart failure can also occur because of a problem with the heart rhythm.
- Whatever the cause of heart failure, some of the symptoms that result are the same. These include exercise intolerance—an inability to stay physically active—plus fluid and water retention. That’s the edema in Joe’s legs.
- The water retention can also occur in the abdomen and lungs—what’s called congestive heart failure. There is often also a rapid or irregular heartbeat, dizziness, fatigue, and weakness. Congestive heart failure is the leading cause of hospitalization in the United States among patients older than 65 and is one of the most common causes of death.
- To confirm Joe’s diagnosis, a sleep study can be done; although in this case, the history and physical are so clear that it might not be necessary. A sleep study entails having a patient sleep while hooked up to several monitors that can detect via brain waves what part of the sleep cycle a person is in.
- Simultaneously, monitors check blood oxygen levels; plus, monitors on the chest wall can detect if a person is making a respiratory effort. Another sensor can detect airflow through the nose or mouth, and if necessary, yet another sensor can even measure the carbon dioxide in the breath.

- Joe's sleep study confirmed that he has many, many complete apneas at night, during which his blood oxygen falls dramatically. During some of the apneas, he struggles to breathe; during others, he doesn't even try.
- Joe he has a mixed picture of both obstructive apnea (when the airway closes up) and what's called central apnea, where the brain isn't even driving breaths. This is typical of Pickwickian syndrome. The sleep study also confirmed that he does not have narcolepsy.

### **Treatment: Weight Loss**

- The treatment of obesity hypoventilation syndrome starts with weight loss. This is not easy to do, and often patients are not successful in losing weight. However, if weight can be lost, sometimes even a small percentage, there can be a big improvement in sleep quality and ventilation.
- For a patient like Joe, who is already in heart failure, weight loss is still a goal, but more aggressive therapy would be started right away. This would include ventilatory assistance during sleep, using a mask device that can provide positive pressure—a sort of push on the air to keep the airway open and make sure that there is airflow both in and out. The device also makes sure that enough breaths are taken each minute to ensure adequate ventilation.
- Joe also needs treatment for his heart failure. This may include diuretic medications to increase urine output and decrease retained fluid; it may also include medicines to get the heart to pump harder or more efficiently, plus medication to control Joe's blood pressure.
- If treatment of his obesity hypoventilation syndrome itself is successful, his heart can recover, and he may not continue to need these heart medicines, but for now, there isn't time to wait and see.
- The most aggressive therapy to help patients like Joe lose weight is bariatric surgery, which includes methods like stomach stapling

or intestinal bypass to decrease the amount of food he can eat or decrease the number of calories that he can absorb.

- In Joe's condition, with heart failure, this kind of surgery is too risky, but perhaps with some improvement he may be able to tolerate a bariatric procedure. Improvements in bariatric techniques are making the surgery less risky, but they're still not suitable for patients like Joe.
- Obesity can lead to heart failure. Obesity also contributes to orthopedic problems like bad knees and hips, high blood pressure, coronary artery disease, some cancers, cholesterol disorders, stroke, liver and gallbladder disease, etc.

### Important Terms

**apnea:** Cessation of breathing.

**congestive heart failure:** Insufficient output of blood from the heart, leading to fluid accumulation.

**edema:** Swelling, typically of an extremity.

**hypoventilation:** Insufficient breathing, resulting specifically in increased carbon dioxide in the blood.

**tachycardia:** Fast heart rate.

### Suggested Reading

Chokroverty, *Questions and Answers about Sleep Apnea*.

Dickens, *The Pickwick Papers*.

## Questions to Consider

1. What are the health consequences of poor or inadequate sleep?
2. The biggest historical health challenges have been poor nutrition, sanitation, and infectious diseases. What are the new challenges for the 21<sup>st</sup> century?

# Shaking Sammi

## Lecture 16

**T**he case in this lecture illustrates one way that medical cases proceed: A logical chain develops from a chief complaint, step by step, to a diagnosis and treatment plan. One question, correctly answered, leads to another, and eventually, the last question gives us our final answer. But that's not always the way it works. Real medical cases sometimes have blind alleys and distractions and, frankly, misleading clues that lead to a twisted medical journey. And, sometimes, real patients have multiple diagnoses—sometimes related, sometimes unrelated—that contribute to their symptoms. Remember to keep an open mind, and pay attention to details.

### A Shaking Infant

- On a snowy winter night in Boston, a four-month-old African American girl named Samantha is brought to the emergency department, and the chief complaint, as written on a form by the parents, is: “She’s shaking; is something wrong?”
- Samantha, or Sammi, has been healthy. She’s been nursing well and growing well. But over the last three days, she’s having periods of time when she seems to either go stiff or kind of shake. They saw their family physician earlier today, but she didn’t see an episode and thought maybe the baby was having some reflux. Worried, the parents brought her to the emergency department.
- This could be a seizure. Babies are actually a high-risk group for seizures, because there can be brain malformations or metabolic problems that could just be coming to light. Babies are also the highest-risk group for brain infections like meningitis.
- Or maybe it’s not really a seizure. There are several neurological symptoms that can kind of mimic seizures, at least at first. For example, sleep myoclonus is the name for those few jerking movements that many people have as they fall asleep. Another



common benign, normal movement is a shuddering spell, which looks like a quick sort of trembling movement.

- Or this could be something not neurological at all, such as reflux. All babies spit up, but some find it painful. Occasionally, we will see a baby with reflux from the stomach up into the throat who arches and stiffens, looking in many ways like a seizure. This is called Sandifer's syndrome.
- Or, maybe, this will turn out to be nothing at all—or nothing that has a name. Babies will sometimes move in kind of weird ways. Odd movements, including some trembling or shaking or jerking, are just something that babies sometimes do.
- Sammi's parents agree that the shaking or funny movement she does sort of comes out of nowhere. It can happen at any time. The shaking lasts about three or four minutes, and then it stops.
- The family history doesn't add much. There are no health problems reported in the parents; there's no family history of **epilepsy** or seizures or movement disorders. Her vital signs are normal, including temperature, pulse, respirations, and blood pressure.
- While examining her, you notice that both of her hands start rhythmically trembling or jerking upward. To determine whether this is a seizure, we'll reassess how she looks overall. Her color is good, and she's not having any trouble breathing—but when we try to engage her eyes, they have kind of rolled up and aren't looking at anything. Her attention is no longer engaged with her environment.
- If you think a baby, or anyone else, may be having a seizure, gently hold or touch the extremity that's shaking. Normal baby trembling stops with a gentle touch. Sammi's shaking does not stop when you touch and hold her hands. This is a seizure. We'll have to figure out why, and what we ought to do about it, but first, it's time for first aid and stabilization.

- When someone—anyone—is having a seizure, first let them lie down so that the head is at the same level as the heart. This is the same thing you do when someone faints or collapses, to maximize blood flow to the brain. Loosen any tight clothing. Glance at your watch so that you know how long this might go on.
- Don't put things in people's mouths. There is a myth that people might swallow their tongue during a seizure and that somehow you need to prevent that with a spoon or something. That's just false; it doesn't even make anatomic sense. Putting a spoon or anything in someone's mouth may cause gagging and vomiting, which would be very bad during a seizure.
- In babies especially, seizures are often caused by metabolic conditions, including low blood sugar, low calcium, or low sodium or high sodium. Also, any kind of brain injury or problem can cause seizures. Fevers of any cause can sometimes trigger seizures in young children. Another cause is trauma. Furthermore, a large proportion of seizures remain unexplained, probably 25 to 30 percent in babies.
- The results of Sammi's blood tests show that her blood calcium is very, very low; normal would be from about 9 to 11, and Sammi's is 6.5. Such a low level can cause seizures.

### **Low Vitamin D**

- Calcium is essential for life and for growth, and there are elaborate and interconnected mechanisms for ensuring that the right amount of calcium is absorbed and maintained in the body.
- Ingested calcium is actively taken up by cells in the small intestine and transported within these cells by a specific calcium-binding protein. That protein acts as a little carrier, and the more of these proteins there are in each absorptive cell, the more calcium will make its way from the gut into the body.

- The amount of these carrier proteins produced in each cell is regulated by vitamin D. Even if there is plenty of calcium in the diet, if there is not enough activated vitamin D, the gut will not efficiently absorb calcium.
- Vitamin D itself comes from two sources: It can be ingested as part of the diet, or the human body can essentially manufacture it in skin cells when exposed to sunlight. Natural sources of vitamin D are actually very, very scarce; vitamin D can be found naturally in fish and fish liver, some in beef liver, and perhaps a small amount in eggs and mushrooms.
- Many foods are fortified with vitamin D—that is, vitamin D has been added—including milk, commercial baby formulas, some juices, and some breakfast cereals. Dairy products other than milk are not typically fortified with vitamin D.
- Babies don't get much liver in their diets, and Sammi was relying on mother's milk, which, like unfortified cow's milk, has almost zero natural vitamin D. In this case, Sammi probably can't get enough vitamin D from sunlight exposure. Children with darker skin need longer sunlight exposures to make the same amount of vitamin D as Caucasian children.
- Sammi had all of the pieces in place to put her at risk for low vitamin D: She has dark skin; it is winter (so there is less daylight and less time spent outside); and she is fed exclusively on breast milk, which has no vitamin D. She is also four months old, and by then, babies have often used up their stored vitamin D from birth.
- To confirm our diagnosis, we draw a vitamin D level (it's actually measured as 25-hydroxy vitamin D, which is a marker for the most active form). We expect a level of 30 to 35 to be sufficient. Hers is 3.
- Over the next few days, Sammi is continued on first IV then an oral calcium supplement, plus a big oral dose of vitamin D. She has no further seizures, and she is sent home to continue



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**Breast milk does not contain vitamin D, so babies who are breast-fed are at a higher risk for having low levels of vitamin D.**

nursing, with supplemental vitamin D. She was actually a little low in iron on other lab studies, so it was suggested that she start some complementary foods, including iron-rich meats and fortified cereals.

- Sammi will probably not suffer any long-term effects from this. Her seizures were brief, and she probably only had them a few days. Short and infrequent seizures do not cause brain damage (though any seizures should be investigated and prevented when possible). Keeping Sammi on a diet with adequate vitamin D and calcium should ensure that there are no further seizures and that her bones develop normally.
- Just about every pediatrician recommends nursing as the best nutrition for most babies, unless there is a medical or other reason for choosing formula. Human milk is a great source of nutrition: It's easy to digest, it's cheap, and it provides unique immune benefits.

- However, human milk isn't perfect; it is not a sufficient source of vitamin D. That's why it's recommended that exclusively nursing babies begin an oral vitamin D supplement at birth and continue it until they're consuming vitamin D-enriched foods, milk, or formula.
- This recommendation is especially important for babies with the following risk factors: dark skin, wintertime, not spending much time outside, and living in cooler climates. It's also crucial for babies born preterm, because they've had less chance to absorb calcium and vitamin D from their mother.
- Calcium is an interesting molecule, and it's essential for many life functions. Along with phosphorus, it makes up the mineral matrix of bones, so prolonged vitamin D deficiency can cause rickets in children. The symptoms of rickets can include delayed growth, bone pain, and muscle weakness along with skeletal deformities like bowed legs.
- Adults don't develop rickets because their bones aren't growing, but if they are deficient in vitamin D or calcium, they can have decreased mineral density, leading to osteoporosis and fractures. Calcium is also essential for normal muscle functioning, clotting of the blood, normal heart contraction and rhythms, and normal functioning of nerve cells and the brain.
- The control of calcium levels is actually fairly complicated. Vitamin D has to be activated by metabolism in the kidney and liver, and that step of activation itself is regulated by hormones from the parathyroid gland. Parathyroid hormone along with vitamin D and another hormone, calcitonin, regulate the uptake of calcium from cells that both build and repair bone; they also influence the amount of calcium excreted into the urine. There are multiple overlapping feedback loops that are all in place to keep calcium levels controlled in a very narrow range.

- The role of vitamin D goes far beyond calcium metabolism and bone health. Vitamin D modulates cell growth, regulates neuromuscular and immune function, and helps control inflammation. The exact functioning of vitamin D, and optimal levels of intake for health, are active areas of current research.

### Important Term

**epilepsy:** A neurologic disorder characterized by recurrent seizures.

### Suggested Reading

Hochberg, *Vitamin D and Rickets*.

Pediatrics, <http://pediatrics.aappublications.org/content/122/5/1142.full>.

### Questions to Consider

1. What are the advantages—and disadvantages—of breastfeeding?
2. What sorts of things does a baby do that tells a doctor that his or her brain is normal?

# Hickam's Dictum

## Lecture 17

The case presented in this lecture has multiple interconnected diagnoses. It is a good example of the importance of the history and physical exam and of watching for times when the story and presentation can change midway through a case. Patients can best help their doctors by being honest, but doctors also have to keep in mind that the information they have been given may not always be accurate. Mysteries become even trickier when the clues are wrong, and that can be part of the challenge.

### Episodic Vomiting

- A 39-year-old woman, Sally, comes into the emergency department with a chief complaint of “I can’t stop vomiting.” Sally says that she has had episodic vomiting and some abdominal pain on and off for a few months, but it’s gotten much worse this week, with frequent vomiting every time she tries to eat or drink.
- Vomiting can be caused by a very long list of problems. We often think first of GI conditions, but there are many other conditions, including intestinal obstructions, appendicitis, gallbladder or liver disease, or really disease of any of the other organs in the abdomen or pelvis—the pancreas, the stomach, or the kidneys.
- Many different medications and toxins cause vomiting, as well as **endocrine** disorders and pregnancy. In addition, anything that increases the pressure in or around your brain, or anything that affects the brain, can cause vomiting—migraine, tumor, stroke, or trauma.
- A more extensive review of systems reveals that Sally has also had some headaches for the past few months and that she feels like she’s been unsteady on her feet. She says that her feet get numb sometimes and make it hard to stand.

- Sally has high blood pressure and was severely obese but had a gastric bypass operation four years ago. Since then, she's lost about 120 pounds. She takes pills for her cholesterol and high blood pressure, a prescription **vitamin**, and ibuprofen. She smokes cigarettes, she says, and has maybe one or two alcoholic drinks per week.
- The most notable things from her physical exam are high blood pressure and fast heart rate; overall, also, she just doesn't look very well. There are several indications of dehydration: She's been vomiting for a week, her heart rate is fast, and she has dark urine and infrequent urination. We order an IV and some fluids and give her a dose of a safe anti-nausea medication.
- A head CT comes back normal, and a pulse oximeter shows normal oxygenation. However, her hemoglobin is very low; it's 8 when it should probably be more than 12. In addition, her chemistries show elevated liver enzymes and a positive test for amylase, indicating inflammation in her pancreas. A pregnancy test comes back negative.
- Sally is bleeding in her gut, is vomiting up blood, and is already markedly anemic. It turns out that Sally has bleeding ulcers and anemia requiring transfusions, but both are addressed. At this point, she also has an unsteady gait, complaints of numb feet, odd eye movements, and trouble with memory. In addition, her liver or pancreas problems haven't been explained yet.
- On her neurological exam, Sally has evidence both of **encephalopathy**—brain problems—but also of neuropathy, or myeloneuropathy, which are problems with the nerves or spinal cord. Her memory issues have to involve her brain, and her reduced reflexes and reduced sensation below the knees have to involve nerves or spinal cord.
- This constellation of findings, together, don't seem to be caused by a stroke, which affects only one area of the brain or spinal cord; or



a tumor; or a neuropathy that might be caused by something like diabetes. Something more widespread is going on—something that affects both the brain and the nerves.

### **Wernicke's Encephalopathy**

- Sally finally admits that she has a bottle or so of gin, every day, and has since her divorce several years ago. Sally's health problems—liver and pancreas disease, vomiting and bleeding ulcers, and neurological problems—are all manifestations of chronic alcohol abuse.
- Her combination of memory problems, confusion, difficulty walking, and abnormal eye movements is called Wernicke's encephalopathy—a condition most often seen in people with alcoholism. It's caused by a deficiency of vitamin B<sub>1</sub>, or thiamine.
- A large dose of intravenous thiamine is administered, and within a day, Sally's memory, gait, and most of her neurological problems have improved.
- Thiamine is essential to cellular metabolism. Although it is necessary for the healthy functioning of almost all body tissues, the nervous system seems to be especially sensitive to thiamine deficiency.
- Thiamine must be ingested; humans and other animals cannot manufacture it. It's widely available in many foods, including whole grains and many vegetables. In the developed world, many grain and cereal products are fortified with extra thiamine, making deficiency rare outside of certain high-risk populations.
- A version of thiamine deficiency, Wernicke's encephalopathy, is the combination of mental confusion, unsteady walking, and unusual eye movements. The most common cause of this kind of thiamine deficiency is alcoholism, which interferes with thiamine absorption and utilization.

- Other risk factors for Wernicke's encephalopathy from thiamine deficiency include starvation, AIDS, frequent vomiting during pregnancy, and incorrect baby formulas.
- A growing risk group is people who have undergone bariatric surgery, like Sally. Because the surgery bypasses some of the absorptive part of the gut, patients who have had weight-reduction surgery are at risk for deficiencies of many nutrients, including thiamine.
- Sally probably wasn't taking her high blood pressure medication or her prescribed vitamin supplements. Therefore, she had multiple risk factors for thiamine deficiency: alcoholism, bariatric surgery, and poor compliance with her medications.
- The prognosis of Wernicke's encephalopathy can be difficult to predict. When treated early, many of the symptoms can improve dramatically and quickly with thiamine administration. However, many patients will continue to have some neurological impairment. Some will go on to develop permanent and pervasive cognitive and memory problems that may require institutional care.
- Sally had evidence of other complications of alcoholism. She had abnormal liver tests, and her CT scan confirmed liver damage. Advanced scarring of the liver, called cirrhosis, is most often caused by prolonged alcohol abuse. Cirrhosis can also be caused by infections like chronic hepatitis or by obesity. Cirrhosis may lead to liver failure, requiring transplantation, or it may lead to cancer of the liver.
- There was also inflammation of the pancreas, called pancreatitis, which can also be caused by alcoholism or obesity. Pancreatitis causes intense abdominal pain and vomiting. Sally may have had multiple causes of her GI symptoms—direct stomach irritation from alcohol, gastric ulcers, pancreatitis, liver disease, and thiamine deficiency itself. All of these can cause stomach upset and vomiting.



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**Gastrointestinal symptoms, including abdominal pain and vomiting, can result from excessive alcohol consumption.**

- Alcoholism can also contribute to gastric ulcers, which led to Sally's abrupt deterioration. There can be multiple, overlapping factors; alcohol itself can damage the stomach lining and prevent healing. Alcoholics may not consume regular meals, including fat and protein that protect the stomach.
- And if cirrhosis has begun, the liver disease can lead to a decrease in clotting proteins, so the ulcers bleed more. Liver disease can also lead to increased pressure in the blood vessels in the stomach and esophagus, which may further increase bleeding.
- The effect of alcohol consumption on heart disease and stroke is still being researched. It appears that moderate alcohol consumption, about one drink per day, may improve cardiac risk factors, perhaps by its effect on cholesterol metabolism. But excessive drinking

directly damages the heart muscle and increases the risk of heart attacks and stroke.

- People with alcoholism also have an increased risk of some cancers, pneumonia, osteoporosis, diabetes, neuropathy, and mental illness. There are also increased risks of death by suicide and motor vehicle accidents, domestic violence, and other addictions.
- Alcoholism is frequently associated with obesity, too; alcohol is a significant source of calories, though it doesn't offer much in the way of actual nutrition, and it will make you fat. And, of course, obesity then contributes to liver disease, heart disease, diabetes, and everything else that's already going wrong.

### Managing Weight

- Obesity is a huge problem in the United States, and it's rapidly becoming the most significant health problem in the entire developed world. In fact, overnutrition—eating too much—may have already overtaken malnutrition as a cause of death, worldwide.
- The causes of obesity are complex. It's tempting to just look at obesity as a simple consequence of eating too much while exercising too little, but there is clearly more to the story. Our weights are also influenced by genetic and environmental factors that go beyond just diet and exercise.
- For now, therapeutic options for patients struggling with obesity are limited. Changes in dietary habits can lead to permanent improvements in weight and health, but they're difficult to maintain and don't usually work.
- Improving exercise habits can improve health (even if weight isn't lost), but that may not be practical, and people who are significantly overweight may not be able to exercise as much as they would like. Still, diet and exercise habits should be part of counseling to help patients of any age reach or maintain a healthy weight.

- There are also some kind-of-overlooked, simple eating strategies that may help.
  - People who eat slower tend to consume fewer calories. So, slow down, chew, drink water, and have a relaxed meal—rather than rushing or eating in the car.
  - Eating out in restaurants increases calories tremendously; portions are large, and restaurants cook with plenty of fat and butter. Order only an appetizer, or split an entrée.
  - The simple step of avoiding calories in soda and other sweetened beverages can have a huge impact on weight. For an ordinary adult, just skipping one 12-ounce soda per day, for a year, will lead to about a 10-pound weight loss.
- At this point, there are no good medicines available to help manage weight. Some may curb appetite a little or interfere with nutrient absorption, but they have significant side effects and may actually increase health risks. We need better ways to control appetite and calorie intake, but so far, we don't have those medicines yet.
- After procedures like bariatric surgery—which is the most aggressive therapy to help with weight loss—patients like Sally are at risk of nutritional deficiencies; they may not be able to absorb enough micronutrients from ordinary food. Deficiencies can include not only thiamine, but also copper, zinc, folate, and vitamin D.
- Patients need to be counseled before and after bariatric surgery on the importance of taking appropriate dietary supplements. Because more and more of these procedures are being done, physicians need to remember the special risks of nutritional deficiencies in patients after weight-loss surgery.

## Important Terms

**encephalopathy:** Dysfunction of the brain from any cause.

**endocrine:** Relating to glands that secrete hormones into the blood.

**vitamin:** One of a group of compounds that are essential to be ingested in small quantities to maintain health and life.

## Suggested Reading

Carpenter, *Beriberi, White Rice, and Vitamin B*.

Gratzer, *Terrors of the Table*.

## Questions to Consider

1. In the developed world, who is at risk for nutritional deficiencies?
2. How can a doctor tell if a patient isn't being truthful?

# Forgetting Jerusalem

## Lecture 18

**Y**ou have about a three-hour window after a stroke where clot-busting medicines can help, and the quicker the evaluation, the better. This is not something that can be done at your doctor's office or something you would call for an appointment about. Call 911, or get to a hospital emergency department as quickly as possible. Overall, about 50 percent of strokes could be prevented through better lifestyle choices: not smoking, maintaining a healthy weight, and exercising regularly.

### A Stroke?

- In the emergency department, an older man is being pushed in a wheelchair. He's with his daughter, who gives us the chief complaint: "I think my Daddy is having a stroke." Our patient's name is Ramesh, and they're hooking him up to monitors while we get some basic history.
- Ramesh's daughter tells us that he is 61 years old, and he's a barber. She says that he was working, and all of a sudden, he kind of slumped to the floor. His right hand and arm got kind of loose, and since then, he can't talk. This happened only eight minutes ago.
- It's likely that Ramesh had a stroke, but we shouldn't assume that yet. There is a differential diagnosis, a list of so-called stroke mimics—including seizure, fainting, hypoglycemia, brain tumors, and migraines.
- This is a situation where it is better to immediately deal with what's most likely, a stroke, because immediate recognition and treatment can really make a difference. If it ends up not really being a stroke, there is no harm done in waiting to diagnose something different.
- Ramesh's daughter says that her dad is really healthy. He has type 2 diabetes but has been really good about his medications; his blood

sugars have been mostly normal. He also has high blood pressure and takes a water pill for that.

- Suddenly, Ramesh looks much better. He's sitting up, smiling, and holding up his right arm. He says that he feels fine. So this wasn't a stroke, after all—it was the beginning of a stroke, but it stopped on its own. What Ramesh had is sometimes incorrectly called a ministroke, but its real medical name is a transient ischemic attack (TIA).
- A stroke, or **cerebrovascular accident**, occurs when there is inadequate blood flow to an area of the brain. Neurons or brain cells in the affected area die, resulting in permanent (or near-permanent) loss of functioning. The exact symptoms will depend on what had been the functioning of that area of the brain.
- A stroke in the stripe of brain that controls motor functioning will cause weakness; a stroke in the back of the brain, the occipital area, will affect vision. Strokes don't have to follow exact functional boundaries; sometimes these symptoms overlap. Strokes can cause problems with emotional control, attention, drawing ability, memory, speech, and more.
- In Ramesh's case, what happened was a brief, temporary blockage of flow—long enough so that the brain cells in that area were affected and stopped functioning, but short enough so that when the blood supply resumed, the cells survived and returned to normal. This is most typically caused by a clot in one of the arteries that supplies the brain. These clots, if you're lucky, can dissolve or get dislodged, allowing blood flow to quickly resume.
- While a general examination of Ramesh is absolutely normal, when we listen over his neck, to his blood vessels, we hear a humming sound called a **bruit**, which is a noise, kind of a rushing or blowy sort of sound, that's heard over an artery when there is some kind of occlusion.



- In this case, we're concerned about a blockage from a clot in the brain, and it could have come from a plaque that's accumulated in the carotid artery, in the neck. A bruit isn't a great, reliable physical finding, but hearing this bruit in Ramesh makes us more suspicious that in the carotids there's a blockage that could have led to his symptoms.
- The physical exam is normal. In addition, Ramesh had a CT scan of his head to make sure that there isn't a hemorrhage, or bleed in the brain. The CT is normal. Ramesh wants to go home.
- The risk of a full-blown stroke after a TIA is probably about 20 percent within the first year; the risk for a stroke within the next few days might be as high as 5 percent overall, but there are some known risk factors we can assess.
- The highest risk for a stroke within days of a first TIA occur in elderly patients. Recurrent stroke risk is also higher in people with poorly controlled high blood pressure and also those whose TIA symptoms lasted longer the first time.
- Overall, Ramesh would seem to fit into the lower-risk category, and with good, reliable follow-up and some initial preventive care steps in the emergency department, it's reasonable to send Ramesh home.
- Three days later, the results of the neck ultrasound show that Ramesh has some blockage, in the 50 to 70 percent range, on the left side of his neck. What to do about this is actually controversial. Whether to intervene is a decision he'll have to make with his own family physician, in consultation with a vascular surgeon.
- Because we know that Ramesh has vascular disease in his neck, it will be a good idea for him to have a cardiac stress test to look for potential blockages in his coronary arteries. And, of course, it will be especially important for him to control his diabetes and high blood pressure and to stay on the aspirin.

**TIA versus Stroke**

- The risk factors for TIA and stroke are the same, and they overlap with the risks for coronary artery disease and blockages in other blood vessels. All of these are related to age; the risk of stroke doubles every decade of life, starting at 55.
- Men are at higher risk than women, and there are inherited risk factors as well. African Americans, Hispanics, and Asians are all at higher risk than Caucasians (perhaps because they all have higher rates of hypertension).
- Stroke risk is increased not only by high blood pressure, but also by obesity, diabetes, and high cholesterol. Lifestyle choices like smoking, staying sedentary, and excessive alcohol consumption all increase the risk of stroke, as do some medications. Taking oral contraceptives, especially when combined with smoking in women over 35, can further increase stroke risk.
- The symptoms of a TIA or stroke can start out exactly the same, but the risk of a stroke within seven days of a TIA is doubled among those who don't seek treatment.
- Aftercare of a stroke, after clot-busting medicine or treatment of hemorrhage, often includes prolonged rehabilitative care and supportive care. Some functioning can return.
- Immediately after a stroke, there is a window of a few days or weeks where there can be a fairly rapid recovery of function, at least partially. More functioning is more likely to return with a stroke that affected a smaller area of brain and in people who got medical care quickly.
- The location of the stroke is also a predictor; some areas of the brain seem to be more or less fragile than other parts. Improvement will also depend on the overall health of the patient and whether there were complications.

- The recovery period immediately after a stroke occurs when cells near the area of ischemia start to recover. These are cells that were damaged, but not killed, by the stroke.
- After this initial period, there can still be improvement and recovery—though recovery becomes slower after the first few weeks. After that initial period, brain recovery probably isn't related to individual cells recovering their function, but from other mechanisms.
- To some extent, the brain can rewire connections around an area of damage. Past six months after a stroke, though, there is typically not a lot of further recovery possible. The exact extent of recovery within that six-month window is difficult to predict, but it can be substantial. However, 100 percent recovery is rare.

## **Treatment and Prevention**

- There's quite a bit of research going on into brain recovery after stroke, looking for ways to maximize what's called the plasticity of the brain—the ability of the brain to recover function. Children, especially the youngest children, have the best ability to recover after a stroke, probably because their brains are still growing and developing. Even a massive stroke in a young child can end up leading to minimal long-term disability.
- There seem to be important genetic switches on neurons that control their growth and development and, therefore, the ability of brain tissue to recover. A goal of research is in turning these switches back on, effectively making an adult brain, or parts of an adult brain, think it's young again so that it can better grow and recover.
- For the time being, though, the best stroke treatment is stroke prevention. Control high blood pressure, high cholesterol, diabetes, and overweight; eat a healthy diet with plenty of fruits and vegetables; quit tobacco use; and exercise regularly. People at high risk should consider taking anti-stroke medications, typically medicines that prevent clotting, including aspirin or prescription

medications. These have both benefits and risks, so their use should be discussed with a doctor.

- Another potential preventive therapy for stroke is an omega-3 supplement—a supplement of so-called healthy fats, often derived from fish oils. Some studies have shown that fish oil taken as a supplement can reduce strokes, but other studies haven't been as persuasive.



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**Eating healthy food and exercising regularly could help prevent stroke.**

- People who experience early signs of stroke or TIA need to be evaluated as quickly as possible, but there is sometimes a delay. Any sudden symptom of neurological dysfunction—including weakness, speech problems, altered sensations, loss of consciousness, trouble seeing or walking—is a potential stroke symptom that needs to be evaluated very urgently.
- Sometimes an individual experiencing a stroke seems to not notice the symptoms or **deny** symptoms that are really obvious to other people, so it may be up to friends or loved ones to insist that people with stroke symptoms seek care.

### Important Terms

**bruit:** A noise caused by turbulent flow in a blood vessel.

**cerebrovascular accident:** Stroke—brain damage caused by insufficient blood flow.

**deny:** In medical lingo, “deny” means that the patient says the symptom in question did not occur. It does not imply that the patient is being untruthful.

## Suggested Reading

Lindley, *Stroke*.

Sacks, *The Man Who Mistook His Wife for a Hat*.

Spence and Barnett, eds, *Stroke Prevention, Treatment, and Rehabilitation*.

## Questions to Consider

1. What information is needed to decide whether or not to perform a medical procedure or test?
2. What sorts of medical problems mean that a patient should go directly and immediately to the hospital?

# Sherlock's Investigation

## Lecture 19

**A**s either a doctor or a patient, don't decide on a diagnosis and then look for the observations and tests that fit your theory. Instead, you should collect your data, keeping an open mind, and then see if there's a theory that fits the facts you've collected. In other words, every diagnosis is a working diagnosis. As the facts change, your diagnosis might change, too. Don't paint yourself into a diagnostic corner, and don't assume that your diagnosis, even if it made sense when you came up with it, is still correct. When there's new data, it might be time to think again.

### Feeling Nauseous, Dizzy, and Weak

- We're working at the student health center of a big university today, seeing college students and faculty. Our patient is a 22-year-old Hispanic woman named Elena whose chief complaint is "I feel terrible."
- Elena says that she has felt nauseous for several days, started throwing up today, and now she feels dizzy and weak. There have been no fevers and no sick contacts. There has been no diarrhea and no abdominal pain—just nausea.
- Elena has a fairly straightforward history, and her vital signs are normal. Her physical exam is normal, and so is a urine test. You give Elena a dose of a medication to decrease nausea and have her stay in your office for a few hours.
- You recheck on her a few times. There's no more vomiting, and she says that she feels better. Still, when she gets up to leave, she seems unsteady on her feet, almost like she might faint. This could be from losing fluid from the vomiting. She is a little dehydrated, but fluids perk her up.



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**When a patient is diagnosed with multiple sclerosis, it can be shocking, but the disease is common, and support groups are available.**

- Four weeks later, Elena returns, saying “I can’t see straight.” She thinks her vision has become fuzzy over the last few days, especially when reading. It’s sort of gradually gotten worse and has maybe been worse toward the end of the day. She says that she just thinks she needs glasses. By the way, her nausea has stopped, and she feels much better in that regard.
- Elena’s vital signs are normal, and her eye exam is normal. Her vision is fine when she covers one eye; in other words, one eye at a time, everything was clear. However, she came into the clinic worried that she wasn’t seeing right when she was reading. Something isn’t right. She thinks it’s due to stress and leaves the clinic.
- Three weeks later, Elena returns to the clinic. She says that she’s been having urinary accidents, or urinary incontinence, for a few days, and she’s assuming that it is a urinary tract infection (UTI). In fact, she’s had this same symptom before and was treated for

a UTI. But the facts—the history and physical exam and normal urine tests—don't support the diagnosis of UTI. They support the diagnosis of a neurological problem.

- Elena seems to have had one problem that kind of gets better, and then a different one. Her symptoms are occurring at different times. The incontinence has happened a few times before, and it's gotten better and then worse again. This is kind of an unusual kind of pattern.
- Stroke, brain tumor, infection, and migraines can all be ruled out. A young, healthy woman with neurological manifestations that differ and come and go over time leads to only one kind of diagnosis at this point: It is likely that Elena has multiple sclerosis (MS).

### Confirming the Diagnosis and Breaking the News

- There are a few tests that Elena needs to confirm the diagnosis. A more thorough neurological exam should be done, including tests of balance, strength, coordination, and memory.
- Before breaking the news to her, we'd like to more about her social support and who she'll be depending on to help her through this. Family and friends are going to be crucial.
- We'll want to schedule an MRI, and Elena will probably need a **lumbar puncture (LP)**, though this will probably be done after referral to a neurologist for specialist-level care. Many centers have multidisciplinary clinics for MS patients to provide the services of neurologists, advanced-training nurses, social workers, psychologists, and other medical professionals. That's where Elena needs to be.
- We have to tell Elena what's going on—she needs to know—but we don't want to be just a fire hose of information. After gently breaking the news to Elena, we'll give her some time and answer her questions. We'll make sure to ask her whether she's heard of MS and what she knows about it.



- Elena may have an idea of what MS is, but we need to tell her that every case is different and that her symptoms may be nothing like those that she may have heard about. We don't want to list every possible symptom that anyone with MS has ever had; instead, we'll stress that there is a tremendous amount we've learned about MS, and a lot of new treatments have become available, and there are more on the horizon.
- MS is common, and we'll try to connect Elena to appropriate support groups that include young women her age. We're going to help Elena get plugged into the MS clinic, and we're going to help make sure she gets the care she needs. And even though a specialist neurologist will be in charge, we're still going to be there to help.

### **Multiple Sclerosis**

- Multiple sclerosis is the most common debilitating neurological disease that affects young adults. Most cases manifest between the ages of 20 and 40, and women are far more likely to be affected than men. There is a strong genetic component to MS: People from certain ethnic groups, especially Caucasians who may have had roots in Scandinavia, seem to be most vulnerable, and MS is 20 times more common in close relatives of people with MS than in the general population.
- But there is more than genetics. Identical twins have only about a 30 percent concordance, meaning that 70 percent of identical twins of people with MS do not themselves develop MS, despite having identical genetic material.
- In addition to a genetic vulnerability, there must be important environmental factors at work. MS is more common in communities farther from the equator, perhaps because of reduced sunlight exposure, leading to lower vitamin D. People who move from an area of high risk to an area of low risk before puberty, but not afterward, seem to have their lifetime risk reduced.

- There have also been multiple outbreaks or clusters of MS, suggesting a possible infectious contributor; there have been many proposed possible infections, though none seems to be the single cause. Smoking, diet, occupation, and socioeconomic status all may also contribute. The cause of MS, as with many other health problems, likely relates to multiple overlapping genetic and environmental factors.
- MS causes damage to the central nervous system (CNS), meaning the brain and spinal cord. There are two major pathological features; one is the destruction of myelin, the insulation around nerve fibers. Myelin makes a sheath around nerve fibers that dramatically increases the speed and efficiency of the transmission of nerve impulses. Without myelin, basically, nerves don't work at all or might be slow and unreliable. This demyelination had been thought of as the main, characteristic pathological feature of MS.
- However, damage can also occur from injury to nerve cells themselves. The affected areas of brain tissue are called the lesions of MS, and at least some of them can be seen on MRI scans; however, the correlation between what's seen on the scan and the clinical effect of the lesion isn't exact. Small lesions can cause significant symptoms, large lesions can cause minimal or zero symptoms, and sometimes symptoms can occur with no visible lesion at all.
- Lesions in MS can come and go, with apparent healing of affected areas while other areas develop new lesions. That's very characteristic of most MS patients: waxing and waning symptoms as different areas of the CNS become more or less affected.
- MS is thought of as an autoimmune disorder, because there is activation of the immune system and inflammation leading to damage in the brain. Also, like other autoimmune diseases, it affects women more than men and starts relatively early in life.

- However, potent anti-inflammatory medicines that suppress flare-ups of MS don't necessarily prevent the long-term progression of MS, leading some to think that there is more to MS than autoimmunity. There's a lot of research going on, and there is certainly more to learn.
- The symptoms of MS depend on where the lesions are. Vision problems are quite common, usually caused by inflammation in the optic nerve. There can be sensory symptoms, including tingling, numbness, or pain; muscle weakness or spasms; or problems with balance and orientation that may contribute to difficulty walking. Fatigue is also a very common and significant symptom of MS, and fatigue can worsen all of the other neurological manifestations.
- Other common symptoms that can progress or wax and wane over time can include bladder and bowel problems, sexual dysfunction, problems with speech and swallowing, cognitive and memory issues, and depression or other psychiatric problems that can be very debilitating.
- MS symptoms can flare up at any time but often seem to have certain triggers. These can include infections. Even relatively ordinary, mild infections, such as a bladder infection or strep throat, can exacerbate underlying MS symptoms. Environmental stresses like heat, cold, or dehydration can be very problematic, and many patients also find that emotional stress can lead to worsening symptoms of MS.
- MS, itself, is not a fatal disease; most people with MS have a normal or nearly normal life span. But the effects of MS on quality of life can be very substantial. Twenty years after diagnosis, most patients remain independent and ambulatory, though some will use a cane for balance or an electric scooter to help prevent fatigue.
- Some patients, maybe 20 percent, will actually have very little progression after their initial presentation; on the other end of the spectrum, about 20 percent may have rapidly progressive disease.

Most patients fall in the middle, with remissions and relapses and a gradual overall progression.

- Although there is no curative therapy, there are a lot of options for medicines that slow or prevent the progression of MS, and there are many ways to treat at least some of the lifestyle complications.

### Important Term

**lumbar puncture (LP):** Sometimes called a “spinal tap”—inserting a needle between the vertebrae to collect cerebrospinal fluid or instill medication.

### Suggested Reading

Jelinek, *Overcoming Multiple Sclerosis*.

Wen and Kosowsky, *When Doctors Don't Listen*.

MS Soft Serve, <http://mssoftserve.org/>.

### Questions to Consider

1. What characteristics do you want your doctor to share with Sherlock Holmes?
2. Does a wrong diagnosis always mean that the doctor made a mistake?

# The Boy Who Doesn't Speak

## Lecture 20

**S**tudying how the mind works and how children think is challenging. We know that children can have potentially devastating problems with the way their emotional and cognitive minds develop, but how best to identify and help these children is not always so clear. The challenge with autism is understanding how the human mind develops and functions. There is a lot of controversy about this diagnosis, what causes it, how to treat it, and even how common it is.

### Speech Delays

- Our first patient in the pediatric clinic is James, who is coming in for his routine two-year-old checkup. His parents express the chief complaint: “We don’t think he talks right.”
- Because this is James’s well check, or checkup, we go through some basic information first, before addressing the questions the parents have. James’s growth is fine, and he hasn’t had much in the way of medical problems.
- The parents have concerns in two areas: feeding and communication. They say that James started speaking late, when he was around 18 months old, and that he just doesn’t talk as much as other two-year-old children.
- He uses only two words consistently: “ball” and “no.” Sometimes, he’ll be able to say words back, to repeat back what he heard, but he doesn’t really use those words to communicate. They’re especially worried because James really hasn’t seemed to make much progress since he started talking at 18 months.
- Most two-year-old children can put two or three words together, making a simple sentence. James does seem far behind in at least the expressive part of speech. In pediatrics, we call this a

developmental delay—a skill that most children have acquired by now but that our patient seems to lagging behind with.

- Many medical problems can contribute to language or other developmental delays, so we have to keep an open mind, and we have to keep an eye out for other clues, to find the best way to help our patient.
- Aside from preterm birth, James has had no specific risk factors for developmental problems that we've identified. And on the developmental history, we've learned that he's about 12 months behind in expressive language, using only a few rudimentary words. He may be a little behind on receptive language skills; his fine and gross motor skills seem okay. He has many atypical sorts of behaviors in the realms of social interactions and play styles. And, as far as we can tell, he seems to be bright and intelligent.
- Children with an isolated expressive speech delay—that is, there is nothing atypical in the development or history aside from the fact that they're just kind of “late talkers”—have an excellent prognosis. Most of those children do very well and catch up after a bit of a late start.
- But James seems to have more going on here, especially with some of these behavioral and social and interactive skills. In addition to his speech-language delay, he's not really acting like a typical toddler.
- The physical exam is a crucial part of the evaluation of developmental problems. We'll use that time not only to observe James's skills and interactions, but also to look for any sorts of findings that might indicate a specific diagnosis or might hint at a certain kind of diagnosis.
- It was a fairly difficult exam—James did not like to be touched and seemed difficult to distract—but as far as we could tell, the exam seemed normal. A good hearing test is absolutely essential for any

child with language delay. This could be a problem with hearing. If he doesn't hear well, it will prevent James from learning words and could also explain some of his behavior, especially the limited way he interacts with others.

- We've become suspicious of a specific diagnosis: autism. James's hearing test comes back normal. It's time to ask James's parents a few more questions and gently discuss with them our concerns.
- We should try to give the parents a brief outline of what autism is and stress that early identification and treatment can really help these children learn these skills. Autism is very much a learning disorder. Some things that most children learn automatically children with autism need to work at and need extra help to learn.
- However, exactly what information to share, and how quickly to share it, really depends on how the family is doing. This kind of diagnosis can be truly life changing or maybe even life shattering.
- The doctor needs to stress that there is good treatment for autism and that most children diagnosed in the first several years of life are able to make big improvements in communication and social skills.
- There are children with more severe autism, and the prognosis for those children is not as good. This includes children who have a low IQ, especially children with Down syndrome or complicating medical conditions. Sometimes there isn't really any reason why one child is so severely affected, at least not a reason we understand yet. But most children with autism are mildly to moderately affected, and therapy and special education can really help.

### **Autism Spectrum Disorder**

- Autism—or, as it's now more formally called, autism spectrum disorder (ASD)—is a complex neurodevelopmental disorder that's characterized by three distinct though overlapping problems: impairments in social interactions; impairments in communication; and a pattern of repetitive, stereotyped behaviors.

- One of the earliest and most characteristic indicators of autism is a failure of the development of what's called joint attention, which is a child's ability to share interests and experiences or to request things from others using gestures, eye contact, and verbal communication.
- For example, children without autism (called "neurotypical") will point at things, usually by 12 to 15 months. They'll point when they want you to look at something, or they'll point when they want something. They'll also understand when other people point to look at the thing that someone else is interested in, to share that experience.
- There are other ways to share like this, too. Neurotypical children will bring toys to caretakers to show them what they're interested in, and during play, neurotypical toddlers will frequently look at their parents to make sure that they're paying attention, and they'll deliberately sort of "show off" to get attention.
- There is some research that shows that failure of joint attention in autism isn't just characteristic, but that it may be the essential early step that leads to other eventual symptoms. Joint attention—paying attention to what parents are paying attention to and enjoying positive feedback for doing this—is exactly how babies learn to communicate and interact. If that shared attention isn't working correctly early on, it may lead to missing out on the learning of all sorts of social and behavioral skills.
- Later on, other typical symptoms of autism develop. These frequently include repetitive, stereotyped behaviors, such as head banging, rubbing, or spinning. Routines can become very rigid, and children with ASDs (and, thus, their parents) may find breaks in routine very difficult.
- Children with autism like to play, and they find their play soothing, but their play tends to be different from that of neurotypical children. They'll perhaps be fascinated by the details of an object





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**Autism, a disorder that affects physical, social, and language skills, is first detected in infancy.**

or find ways to use an object that's not based on pretending or on what the object was meant to be used for. Rather than throw a ball, they'll stare at it as it reflects colors, or rather than push a toy car, they'll spin the wheels.

- There's a tremendous range of autism, which is why we now refer to an "autism spectrum," and not all children with autism will show all of the symptoms. Complicating the picture is that many children with autism will also have genetic disorders (such as Down syndrome) or a history of other medical problems (including fetal alcohol exposure or cerebral palsy), and many also develop psychiatric disorders, including anxiety disorders or obsessive compulsive disorder.
- There's a lot of overlap, and the picture changes as a child develops. One thing is for sure, and it's crucial to communicate this to parents: No two children with autism are the same, and the most important challenges to tackle will depend on the individual child.

## Controversies and Early Detection

- There are many controversies surrounding autism. One of them concerns the tremendously increased rates of autism being seen in many areas of the developed world. In the United States, autism affects up to 1 in 88 children.
- Good longitudinal studies, over time, have shown that the incidence of autism hasn't changed much when you use the same diagnostic criteria across age groups. Over the last 20 years, we've really changed the definition of autism to become much broader, so many more children are being caught under an ever-widening umbrella.
- In addition, there is an effect of diagnostic substitution: While the diagnoses of autism have seemed to go up, the diagnoses of mental retardation have gone way down.
- The rates of severe autism haven't changed very much either. Almost the entire increased incidence is seen in more mildly affected children. However, even mild manifestations can be very difficult for children and families, and the treatment can be very costly.
- There is another huge controversy over what is causing autism. Briefly, there seem to be both genetic factors and environmental influences. The environmental clues that seem to be most influential are those that occur very early in life, or even during pregnancy.
- Although children aren't typically diagnosed with autism until maybe even three or four years of age, in retrospect, studies of even very young babies, a few months old, show subtle differences that, though unappreciated at the time, were evidence that something had already happened to cause autism.
- Early identification seems to be the key to treatment. Young babies are especially capable of learning a tremendous amount. Their minds are little sponges. Early therapy to help reinforce the

skills of shared attention and early language development can be very effective.

- We need to do a better job of finding children like James early on—to get them into therapy as soon as possible. While there is no medicine that treats the core symptoms of autism, medication can be useful to treat some of the problematic behaviors. What's far better than medicine, though, is early hands-on therapy, engaging the parents, to practice and teach the skills that these children need to learn.

### Suggested Reading

Brazelton, *Touchpoints*.

Offit, *Autism's False Prophets*.

### Questions to Consider

1. How are children developing differently now than 100 years ago? 1,000 years ago?
2. How can you tell if a disease is caused by environmental exposures, genetics, or both?

# Antarctic Adventure

## Lecture 21

**A**ppendicitis refers to acute inflammation of the appendix, and it's the most common abdominal surgical emergency. About 250,000 appendectomies are done in the United States each year—though the incidence is much lower in the developing world. About 1 in 14 people will experience appendicitis during their lifetimes and will get their appendix removed. Almost all patients with appendicitis have pain. One recent report showed that a history of increased pain while driving to the hospital over bumpy roads correlates well with an appendicitis diagnosis.

### Appendicitis

- The appendix is a small, hollow tube—really more like a small pouch, about four inches long—that comes off the beginning of the large intestine, in the lower right of the abdomen. Sometimes it's referred to as the “vermiform” appendix, meaning that it is shaped like a worm.
- It's thought that the appendix in humans is a vestigial organ—a vestige of a structure that's perhaps important for the digestive processes of other animals, but not for us. There are immune cells in the appendix, so some have speculated that the organ serves to help the immune system develop in the fetus before birth. Removal of the appendix at any age doesn't lead to any loss of function.
- Inflammation of the appendix occurs if anything obstructs its opening. About 30 percent of the time, there is what's called a fecalith, a stonelike piece of stool that you could see on a plain X-ray, but more commonly, it's not specifically known why the opening to the appendix became blocked.
- Whatever blocks that opening, once it's blocked, normal mucus secretions cannot drain, and the appendix swells and becomes distended. Swelling of any of the hollow organ causes pain, which

is first sensed by the nerves within the gut itself. This pain is kind of crampy and usually not severe at first. It's usually first felt in the middle or upper belly, near the belly button.

- Continued swelling leads to a decreased blood supply within the wall of the appendix and invasion of normal gut bacteria, which can now multiply unchecked. The inflammation then spreads through the wall of the appendix and presses on the side of the inside of the abdominal cavity—which is when the pain becomes more sharp and focused and intense, localized over the right lower quadrant of the belly.



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**In almost all patients, appendicitis is characterized by pain the abdominal region.**

- There are usually signs of **peritonitis**, including marked tenderness. Without treatment, perforation of the wall of the appendix will occur, spilling infected contents into the abdomen. In the past, this was often fatal, but modern surgical techniques and antibiotics mean that the overall mortality even after a perforated appendix is low. Still, it is best to diagnose and treat appendicitis before the appendix ruptures.
- Almost all patients with appendicitis have pain. The classic story (which does not always occur) is pain that begins suddenly in the middle of the abdomen and then, 6 to 24 hours later, moves to the lower right, becoming sharper and more focused.
- The pain, especially once it has moved, is made worse by movement of the patient or tapping on the abdominal wall, so patients with appendicitis, classically, want to lie very still, or if they do walk, they walk slowly, hunching over to their right.

- There is also often nausea, and less often, there is vomiting. **Anorexia**—that is, a lack of desire to eat—is nearly universal and can even be the very first symptom, especially in children. Fever is seen sometimes, most typically low grade. Fever is more common and sometimes higher if the appendix has ruptured.
- Appendicitis doesn't follow the typical pattern of presentation in young children or babies or in elderly people, so those ages have a much higher rate of delayed diagnosis and perforation.
- The diagnosis can also be especially challenging in women, who can have similar symptoms with pelvic conditions including tubal pregnancy, ovarian rupture or torsion, or complications from pelvic infections. Also, some people have somewhat unusual anatomy. Although appendiceal pain is usually in the lower right, the appendix can sometimes refer pain more to the back or on the side—or even be located on the left side in rare cases.

### Diagnosis

- There are many tests that a doctor can do to determine whether a patient has appendicitis. When blood tests are done, they almost always show an elevated white cell count for a patient with appendicitis. However, this is considered a nonspecific finding, because many other conditions can also elevate the white count.
- Blood tests can also rule out liver and pancreas disease; in a woman of childbearing age, a pregnancy test is essential. A urinalysis can also be a useful test, though sometimes the inflammation from the appendix, which can lie near the ureter in the back, can cause some white cells to appear in the urine.
- A plain X-ray can be done to help the evaluation. If a fecalith is seen, that can be diagnostic of appendicitis, though it's not usually present. However, an X-ray can help provide clues for other sources of pain, such as a kidney stone—this could show findings that suggest an abdominal obstruction or perforation.

- Advanced imaging is now often used to confirm the diagnosis of appendicitis, or to rule out other conditions. Ultrasound can be used to visualize an enlarged appendix with a thickened wall, though this requires good technique, and the accuracy of ultrasound depends on the operator as well as patient characteristics.
- For example, it is difficult to get a good abdominal ultrasound on an obese patient. Even under ideal situations, often a normal appendix can't be seen on ultrasound, which limits its ability to rule out appendicitis. However, ultrasound may be especially useful in women to look for other pelvic conditions.
- A CT scan is considered the preferred test, if necessary. It is not as dependent on the operator, and it has an overall accuracy of at least 95 percent and can also diagnose abscesses and perforations.
- However, CT scans do expose the patients to some ionizing radiation, and there's growing concern that the overuse of CT scanning, especially in children, could be contributing to the later development of cancer.
- If the diagnosis is unclear, a CT scan may be very useful prior to surgery; when the diagnosis of appendicitis based on the history and physical exam is very likely, it is preferable to go to surgery without any imaging at all.

## **Appendectomies**

- Historically, overall, about 20 percent of patients taken to surgery for suspected appendicitis turn out to have a normal appendix. Extremes of age—children and the elderly—have a higher rate of missed diagnoses, as do women of childbearing age. That 20 percent figure is probably higher than what's seen now, perhaps in part because of the availability of imaging, but there will continue to be a certain rate of false diagnoses, because of the nature of appendicitis.

- Earlier intervention results in simpler, more successful surgery with fewer complications, but the diagnosis is less certain early in the presentation. A reasonable period of observation, while repeating the abdominal exam—about four to six hours—can be a very useful diagnostic tool.
- However, waiting and waiting, until the diagnosis is 100 percent certain, isn't a good idea. Sometimes it's best to go to the operating room, even knowing that there is a chance that the appendix is actually not the cause of the symptoms.
- In the past, every case of appendicitis needed to go to the operating room; a perforated appendix was usually fatal. But we do have other options for selected cases. If surgery is unsafe—either because the patient is too unstable, has another condition that precludes surgery, or because there isn't an available facility—giving intravenous antibiotics is an alternative to prevent complications until surgery can be scheduled.
- With antibiotics, some patients can have complete resolution of their appendiceal inflammation, but many will have recurrences and will eventually need appendectomy.
- In the case of a perforated appendix, treatment can be either an immediate appendectomy or a prolonged course of IV antibiotics, usually after CT- or ultrasound-guided drainage of the infected fluid. An appendectomy can be done a few months later, after the inflammation has settled down.
- The traditional way to perform an appendectomy is open surgery. These days, appendectomies are often performed using minimally invasive surgical techniques, using a laproscope.
- There are a variety of techniques, but the basic idea is to make one or more small incisions through which a scope, basically a camera and light source on a stick, can be inserted. Then, the abdomen is inflated with carbon dioxide gas—which is used because the gas



can be reabsorbed by tissues, and it's not flammable. Through the laproscope, the surgeon can see everything.

- Laparoscopy can be especially useful when the diagnosis is less clear, because the surgeon can see throughout the abdomen. If appendicitis is confirmed, the appendix can be removed with the help of additional instruments that can enter the abdomen through one or more other small incisions or alongside the scope. Recovery after an uncomplicated, routine laproscopic appendectomy is very fast, and many patients will go home from the hospital in less than 24 hours.
- Laproscopic appendectomy has many advantages. There's better visualization of the entire abdomen, smaller scars, and quicker recovery. However, the procedure takes longer, and it's more expensive, requiring more high-tech equipment.

### Important Terms

**anorexia:** Lack of appetite or disinterest in eating.

**peritonitis:** Inflammation in the lining of the abdomen.

### Suggested Reading

Rogozov and Bermel, "Auto-Appendectomy in the Antarctic."

Stern, Cifu, and Altkorn, *Symptom to Diagnosis*.

### Questions to Consider

1. Should doctors treat themselves for their own medical problems?
2. What are the red flags of serious abdominal pain that needs immediate evaluation?

# A Sunday Drive

## Lecture 22

What happens to a human body when it's pushed to the edge of survival? Imagine that you are in your car on your way to the emergency department for your next shift. A man on a motorcycle passes you, darting into and out of oncoming traffic. He's probably going 60 miles an hour on a two-lane street. Up ahead of you now, you see his back wheel clip the edge of a car. The motorcycle spins out of control and slams into a concrete utility pole. What do you do?

### Motorcycle Accident

- After an accident occurs, the first step is to clear the area. You need to ensure your own safety, making sure that no one is going to drive into you or the victim when you stop to help. You pull over, leaving your blinkers on and leaving enough of your car in the lane to slow traffic.
- Then, you call for help. You're going to do what you can, but you already know that you're going to need an ambulance, and the faster they get here and get the cyclist to the hospital, the better his chance of survival. If other people have stopped to help, you can split up the jobs. Say to someone else, "You, call 911"—don't assume that somebody else has already called.
- Once the ambulance is on its way and the area seems safe, you approach your patient. He's lying on the ground, on his back; his motorcycle helmet has been crushed and knocked off his head. You can see the name "Tommy" airbrushed across the back of the helmet. Tommy is lying awkwardly; his legs look broken, and one shoulder is pushed backward unnaturally.
- The initial care of a trauma or a critically ill patient—including any trauma patient, from any kind of trauma—starts with what's called the primary survey. Medical personnel go through five items, in

order; they always address the step they are on before they go on to the next step. There's a handy mnemonic to remember the five steps of the primary survey: ABCDE.

- The point of this primary survey is to identify and immediately deal with life-threatening problems. In the field, if there is something that is an immediate threat to life, do what you can to fix it; if you can't fix it, continue support and get the patient transported as quickly as possible.
- This primary survey is for medical people—emergency medical techs and nurses, respiratory therapists, emergency department doctors—people who have been trained. Laymen are not expected to know or follow these steps. For most laymen, the most important steps are to protect the victim from further harm and call for help.
- “A” stands for “airway.” Is the airway open? Can air get into the lungs? In an awake patient, you can test this by asking the person to speak; if you can talk, or if you can cough, you can move air. Our patient, Tommy, isn't really moving, and he certainly isn't speaking, so you assess the airway visually. He seems to have no serious facial trauma that would interfere with breathing. With this kind of trauma, you also want to be very careful about moving the head, but he's got to have an open airway to breathe, so if you need to move the head to open the airway, you do it.



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**If you witness an accident, one of the most important steps is to call for emergency medical help.**

- “B” stands for “breathing”—and Tommy does seem to be breathing, albeit slowly and irregularly. You look, listen, and feel: You look at the chest wall to see that it’s rising and falling, at least somewhat, and you listen and feel right over the mouth to tell that at least some air is moving in and out.
- “C” is for “circulation.” Is there a pulse? Is blood being circulated? Yes, there’s a pulse that you can feel. It’s not strong, but it is there. The assessment of circulation in this step also includes control of any serious hemorrhage. If your patient is bleeding, try to stop it with pressure and perhaps a tourniquet. If too much blood is lost, circulation will be compromised. For now, you don’t see any serious bleeding.
- “D” stands for “disability,” referring to your patient’s neurological status. There are several scales and ways to judge overall neurological status, but one of the quickest and most widely used is the simple AVPU scale. “A” stands for “alert,” meaning a normal, alert, fully awake patient. “V” stands for “voice,” referring to a patient who isn’t fully alert but at least responds to your voice, either by talking back or moving purposefully. “P” stands for “pain,” meaning a patient who responds not to voice but only to a painful stimulus. “U” is a patient who is completely “unresponsive,” who doesn’t react to voice or pain at all. At this point, Tommy is a “P” on this scale.
- “E” is the last letter of the primary survey, standing for “exposure” and “environment.” You need to get a look at the whole body. For practical purposes, looking at the back is done as a “log roll,” with someone holding the head neutral. When Tommy is rolled, you notice that the ribs on one side of his back appear to be crushed inward. That means there is a very serious injury to his lung and that breathing may become very difficult.

### At the Hospital

- Once the ambulance comes, Tommy is rushed to the hospital while you follow in your car. The philosophy of emergency medical

technicians (**EMTs**) in a serious, life-threatening situation is to spend a minimum amount of time at the scene—address only immediate threats, and only if you have the equipment and ability to address them—and then get the patient as quickly as possible to where he needs to be.

- On the way to the hospital, do as much as you can to help. One specific task, along with keeping an eye on the ABCDEs, is to try to get good IV access—get IVs started, big lines and multiple ones. EMTs would never delay transport to get those IVs in, but that access is going to be critical to give medicines, fluids, and blood products.
- The emergency department is a different sort of medical setting. In most places, as a physician, you'll make the diagnosis first, and then move logically to therapy. In the emergency department, finding a specific diagnosis is secondary. The main job is to identify the genuinely sick and get them stabilized for admission to the intensive care unit or the floor of the main hospital. It's a different sort of mindset, one where time is of the essence.
- After reassessing Tommy's ABCDEs in the trauma room, you determine that he has deteriorated across the board. In addition, he's now at U, completely unresponsive on the AVPU scale. Although many things can cause this, in a trauma situation, the big ones to think of first are those that could benefit from immediate intervention.
- First, there's direct brain injury. Tommy was going fast and then slammed into a utility pole. He was wearing a helmet, but at that speed, the collision could have done tremendous damage to Tommy's brain by directly damaging or killing cells, by shearing the connections between cells, and by damaging blood vessels necessary to deliver oxygen. This kind of damage can be difficult to assess right after an injury.

- In addition, there's brain injury from swelling, which can also decrease blood flow into the **cranium**. We'd like to get a CT scan to see what's going on in the head. Then, in the operating room, a neurosurgeon's role could be to help open up the skull and evacuate blood collections, relieving increased intracranial pressure. Monitors could also be put into the cranium to more directly measure pressure there.
- But we've got even more immediate problems to worry about. Tommy might be falling further into unconsciousness—because Tommy is in shock. That means that the body's tissues are not getting enough blood; in other words, there isn't enough perfusion. Although there may be enough oxygen in the blood, the blood isn't getting to where it's needed—so insufficient oxygen is being delivered.
- Shock can be caused by a number of different problems, but in Tommy's case, shock is being caused by what's called hypovolemia—there is just not enough circulating blood. We know that he's hemorrhaging in his chest because there's blood coming out of his **chest tubes**, and we know that he's hemorrhaging in his abdomen. We haven't been able to stop the bleeding, and as fast as we can pour blood in, it's pouring out.
- Shock can affect every organ of the body. Many problems caused by shock can pile up on one another, leading to a cascade of worsening organ failure. There are also immunological mechanisms, where damaged tissues from trauma and shock release factors into the blood that themselves lead to a massive inflammatory cascade, inflammatory overactivation, and further tissue damage and circulatory problems.

### Death: Breaking the News

- Suddenly, monitors start blaring. Tommy's heart has stopped. A **defibrillator** is rushed over. You take the paddles while someone squirts clear cold goo on them to improve conduction, and you yell,

“Clear!” You shock once; nothing happens. You shock twice; a heartbeat occurs again.

- More medicines are poured into the IVs to support blood pressure and to stop arrhythmias. It has been four minutes. Moments later, a second code; the heart stops again. You shock again, with no response. Chest compressions are begun, followed by a pause for another shock. Now, the heart is quivering—not beating, just wiggling in the chest—not pumping oxygen at all. It has been eight minutes.
- One more shock leads to a few good heartbeats. A nurse reports that she feels a pulse in the neck. It’s been 10 minutes. The pulse fades, softer and softer, and chest compressions are started again.
- There’s an irregular recording on the heart monitor that becomes just a random squiggle. After 12 minutes, the tracing stops completely. The line becomes flat again, leading to more shocks and compressions. After 25 minutes without a strong, consistent pulse, you, the emergency department physician, look at the clock on the wall and announce the time of death while the scribe records it. Compressions stop, and the ventilator is switched off.
- You need to catch your breath and go meet the family. You’re told that they’re in the waiting room, and they want to come back and see Tommy right away. Families should be told this kind of news together, when possible, so that they can have each other for comfort. They also deserve to have a quiet, private area, and they need to have time with the doctor.
- You tell the family that you did everything you could, but Tommy had very serious injuries, and he couldn’t survive. Some families will want more details, maybe all of the medical details, and you answer those sorts of questions as best you can. You offer your card, even as the emergency physician, for the family to call later, when more questions arise.

## Important Terms

**chest tube:** More formally, thoracostomy tube—a tube used to drain air or fluid from the chest.

**cranium:** The skull, or more specifically, the part of the skull that encloses the brain.

**defibrillator:** A device that delivers a shock to the heart to restore a normal rhythm.

**EMT:** Emergency medical technician.

## Suggested Reading

Nolen, *The Making of a Surgeon*.

Shem, *The House of God*.

## Questions to Consider

1. What obligation should medical professionals have to stop to help people who are ill or injured?
2. How is the viewpoint of people who deal with acute injuries different—the first responders on an ambulance, versus the team in the emergency department, versus the doctors and nurses in an intensive care unit?



# Cough, Cough, Cough

## Lecture 23

**F**or patients, when you leave the doctor's office, you should make sure that you have a clear diagnosis and that you understand what treatment you've been prescribed. Regular follow-up with your primary care doctor is essential when a problem is chronic or recurrent. Bring records of outside visits to your primary doctor, including copies of X-rays and labs, and make sure that every health provider you see knows exactly what medications have been prescribed. Doctors sometimes need to step back and look at the big picture; this can take extra time, but it can be the best way to help the patient.

### Frequent Cough

- Our patient in the general medicine outpatient clinic is Margo, a 49-year-old woman who has come in with her husband with a chief complaint of "I've got this cough again." Margo says that she gets a cough frequently, a bad cough that lingers for weeks, and she keeps seeing doctors, and it gets better, and then it comes back. She thinks this time it's her allergies, because it's the fall, and she always gets this cough in the fall.
- A cough is one of the most common symptoms that drive visits to doctors. Of course, most coughs are brief, self-limited diseases that people recover from without any specific evaluation or therapy at all. Coughing is a normal protective reflex that clears the lungs of secretions and mucus and inhaled dust. But of course, too much of a cough itself is distracting and aggravating, and it can lead to impaired sleep for both the patient and family.
- Some of the most common causes of chronic, prolonged, or recurrent coughing include smoking; both active smoking and passive, secondhand smoke exposure can cause cough. Long-term smokers can develop chronic obstructive pulmonary disease with permanent destructive changes in the lungs.

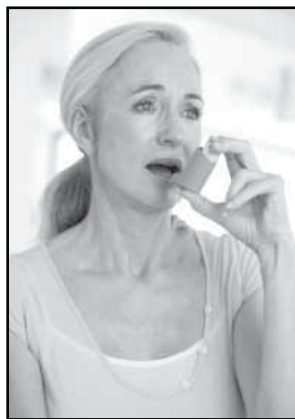
- Asthma is also very common and can cause coughing as a main symptom, sometimes along with wheezing, noisy breathing, or shortness of breath. Prolonged cough can also be caused by environmental or occupational pollution. Any cause of chronic postnasal drip (including allergies or sinusitis) can cause an ongoing cough.
- Reflux—meaning gastroesophageal reflux, from stomach contents coming back up—can cause cough, as can some medications (especially ACE inhibitors, a class of blood pressure medications). Whooping cough, also called pertussis, is probably one of the most common infectious causes of prolonged coughs in adults.
- Frequent, ordinary coughs—just from common cold viruses—can kind of stack up, one after another, and seem like a chronic ongoing cough. We see this in children, sometimes, when they start day care, in young pediatricians starting training, or in teachers or day-care workers. Children or those who work around children can be victimized by very frequent viral infections.
- Less commonly, prolonged coughing can be from heart disease, chronic lung infections, or tumors or cysts in the lungs or bronchial tubes. Problems outside of the chest have to be considered, too—such as something in the larynx or throat, or neurological conditions that lead to excessive secretions or an impaired ability to keep the airways clear.
- Also, any sort of immune-compromising condition can lead to recurring or persistent coughing. Occasionally, we see what's called a psychogenic cough, sometimes related to stress.
- We can ask about the quality of the cough, to try to nail down exactly what it sounds like. There are a few specific coughs that do have very characteristic sounds. Croup is an illness of children— young children and babies mostly—with a cough that sounds like the bark of a seal or a dog. But croup is very uncommon in adults.

- Another characteristic cough is the cough of pertussis, or whooping cough. Classically, this is a staccato, one-after-another cough that goes on for a minute or more, followed by one big inspiration—a whoop. But many people with whooping cough don't actually sound like that and don't make that whoop.
- There's also a distinction that can be made between a wet and dry cough. A dry cough is likely related to irritation, or some condition without a lot of excess phlegm; a wet, phlegmy cough is likely related to infection or inflammation, perhaps caused by sinus disease or allergies.
- But there's a lot of overlap. Pneumonia can sound to some people wet or dry, and so can asthma. And two people listening to the same cough often disagree on whether it's wet or dry. Cough descriptions are not very reliable or helpful, and they certainly shouldn't be something that leads you to narrow down the diagnosis without corroborating information.
- The physical exam reveals that Margo is a healthy woman, overall, but she has an annoying, severe, recurring cough. She also wheezes, at least sometimes, on the physical exam. A wheeze is an almost musical whistling noise that is classically caused by narrowing of the airways in the chest. That can be from a one-time illness—such as pneumonia, where mucus in the airways causes narrowing—or by some kind of tumor or mass that's pressing on one or more airways.
- From Margo's history, this is a recurrent, come-and-go cough that is associated with a wheeze that comes and goes. That's very suggestive of one single, common diagnosis: asthma. In fact, many of the medications Margo's been using on and off for years are actually asthma medications, so doctors have been thinking about asthma before. But apparently this has never been communicated clearly to Margo.

- A first test that's part of the evaluation of any chronic or recurrent cough is a chest X-ray. It's simple and cheap and allows us to can see the heart and lungs and the larger tubes of the airways. Margo's chest X-ray looks fairly normal, but the lungs are hyperinflated—it looks like Margo is taking extra-deep breaths—and there are little areas of slightly denser lungs, suggesting a little bit of fluid in those areas.
- You look back at some older films that have been taken over the last few years, and there is often that hyperinflation, and sometimes there are those little consolidated areas in different places. It's the pattern—what's seen in the series of X-rays, along with the findings of repeated physical exams revealing a wheeze that comes and goes—that is suggestive of asthma.
- One other confirmatory test is done: By using a device to measure Margo's breathing, called a **spirometer**, we see that Margo's airways are clamped down small, especially during exhalation. Then, we give her a medicine called a bronchodilator—a very common asthma medication used to relax and open her breathing tubes—and afterward, her spirometry testing normalizes. We've documented a breathing obstruction that responds quickly to bronchodilators, confirming the diagnosis of asthma.

## Asthma

- Asthma is very common. It affects about 25 million people in the United States, including 7 million children. It causes symptoms by two interrelated mechanisms in the lungs: Part one is inflammation—swelling and mucus accumulation in the airways. Part two is what's called



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**Asthma, which makes it difficult for a person to breathe, can be controlled with inhalers.**

bronchoconstriction, where muscles that wrap around the airways constrict, causing narrowing.

- The main symptoms of asthma, when it's flaring up, are coughing, shortness of breath, and a feeling of chest tightness. Sometimes there can be chest or, more rarely, abdominal pain as well. Symptoms can range from mild to quite severe or even life threatening, and they very characteristically wax and wane, getting better or worse depending on triggers.
- However, many people with asthma have at least some amount of chronic inflammation and symptoms as a baseline, though they may not complain about daily problems.
- People with asthma can have triggers that lead to a flare-up of symptoms, sometimes called an asthma attack. Common triggers can be exercise, cold air, respiratory infections (including common cold viruses), tobacco smoke, or allergies.
- These triggers lead to cough even in people without asthma, which can be a source of diagnostic confusion. For example, allergies themselves cause cough, but usually, there are other symptoms of allergies, such as a runny or congested nose or itchy eyes—or a common cold. Everyone gets some cough with their colds, but when someone's colds often lead to a prolonged, severe cough, that also suggests the possibility of underlying asthma.

### **Preventing and Controlling Symptoms**

- Although there is no cure for asthma, there are important steps to prevent and control symptoms—steps that may also help prevent the overall progression of asthma to a more life-threatening disease. Nonmedical steps can include avoiding tobacco, including secondhand exposure, and avoiding other identified triggers when possible.

- Also, control of allergic symptoms with allergy medications, environmental measures, or immunotherapy can help control asthma, at least in people with allergic triggers.
- Beyond that, medications can very effectively improve the health of people with asthma—when they’re used correctly. There are both quick-relief medications, such as bronchodilators, which are taken quickly at the onset of asthma symptoms for quick relief. These are sometimes called “rescue” meds, and they can also be used as a pretreatment right before exposure to an individual’s known trigger, such as exercise or visiting a family with a cat.
- However, there is a dark side to these rapid rescue medications: Overuse of them, overly frequent use, makes the body less responsive to their effects. Over-relying on these quick medicines may mean that when there’s a more severe attack, these important medicines will not work. In fact, overuse of rescue meds is a risk factor for death from asthma.
- The most important steps in prevention are making the right diagnosis and teaching the family about asthma, including avoiding triggers, controlling symptoms, and using medications correctly, both as preventives and as rescue therapy when there are symptoms. People with asthma need an action plan for when their symptoms occur, and they need to know when to head to the hospital when symptoms are severe or not improving.
- Some things to look for, both for patients and their family, that mean an attack is potentially severe include needing to use rescue medications over and over—that is, taking more puffs than typically needed to control a flare-up. Also, look for unremitting cough, gasping, trouble speaking complete sentences, or any patient who is becoming upset, agitated, confused, or lethargic. These kinds of symptoms warrant immediate communication with a doctor or a quick trip to the nearest emergency department.

- For anyone with chronic symptoms, or symptoms that are intermittent but common or severe, a daily “controller” type of medication is needed. Controllers are underused in the treatment of asthma and are sometimes used incorrectly. They’re meant for daily use, or at least daily use for long stretches of time—for example, through all of allergy season. They do not work quickly, so they’re not the first thing to grab when there is an asthma attack. But regular use prevents flare-ups and controls daily symptoms.
- Many of the medicines used for both rapid relief and long-term control of asthma are given in inhalers, small canisters that create a puff of medication to breathe in. They’re great because they put the medicine where it’s supposed to go, in the lungs, without many side effects. But they’re often used incorrectly. It turns out that proper technique is difficult to master, and it takes repeated teaching and practice. In almost all cases, a plastic spacer device can improve effectiveness when prescribed alongside these inhalers, though they’re underused.

### Important Term

**spirometry:** Tests of lung functioning.

### Suggested Reading

Adams, *The Asthma Sourcebook*.

### Questions to Consider

1. What are the advantages and disadvantages of medical care at a primary care office versus an urgent care center?
2. How do you know whether a cough should be treated with antibiotics?

# A Confused Father

## Lecture 24

**T**he case presented in this lecture illustrates the risks of side effects of medications and, especially, of what's sometimes called **polypharmacy**—taking multiple medications. It is important that elderly patients have an advocate to help them at appointments and make sure the correct history is available. Once a patient is sick, he or she might not be in the best condition to communicate with the doctor and follow through on plans. That goes for mental health and cognitive concerns, but even for almost any general medical concern. In addition, a single doctor who has known a patient well for years can be a strong ally.

### Dementia, Delirium, and Depression

- In the general medicine clinic, our patient is a 90-year-old gentleman named Isaac. He is brought in by his son. You've known Isaac for many years, though he's a snowbird who you see for routine care only about six months out of the year. It's April, and he's come back to town from his usual winter stay in Boca Raton, Florida.
- His son says that he's just not right—that he hasn't been right since he came back. The doctors in Florida said that he has Alzheimer's disease, but Isaac doesn't seem to agree.
- You last saw Isaac about six months ago, and at least then, he was in pretty good shape. His wife had died about a year ago, and you had been worried then about him continuing to live alone. After the funeral, Isaac's son moved back to town into an apartment he could share with his father. That turbulence, his wife's death and moving, had seemed to cause some confusion and a little forgetfulness, maybe not unexpected at Isaac's age.
- At the time, you had him see a neurologist and then a psychiatrist, who had prescribed medication for depression. Isaac seemed to improve and settled into a new routine. Now, it seems—just from a



first impression—that Isaac has had a big step backward in function and cognition.

- Isaac's son reports that Isaac has some good days and bad days—some days when he seems confused. Most days, he doesn't talk, and he can't really dress himself anymore. His son adds that most of the time, he just looks confused.
- Dementia is a progressive decline in memory and at least one other cognitive area. It is very strongly related to age. Dementia is rare under age 50, but it affects 8 percent of those at age 65. By age 90, almost 40 percent of people have at least some dementia.
- The common causes of dementia are almost all related to chronic and progressive brain damage, occurring most often from age-related diseases like strokes or Alzheimer's or Parkinson's disease. Damage can also be related to chronic infections like HIV or from toxins like alcoholism.
- Most causes of dementia cannot be reversed, but in at least some, the progression can be slowed with therapy. Rarely, symptoms of dementia can be caused by thyroid disease, vitamin deficiencies, or a brain tumor.
- The way that different people show symptoms of dementia can vary, but there is always some degree of memory loss. There will also be other evidence of problems with cognition, such as difficulty with language and communication or problems carrying out learned and purposeful movements.
- Sometimes there can be a decline in the ability to recognize objects or tell what they're for. Some people will also have changes in personality and perhaps a loss of social inhibition in their actions or speech.
- One specific cause of dementia that's been mentioned is depression. This is sometimes called pseudodementia in the elderly, because

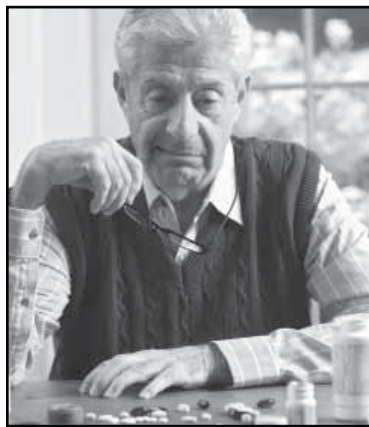
depression can contribute to the symptoms of dementia, and dementia itself can present with symptoms similar to depression. In addition to a sad mood, elderly patients with depression can have symptoms affecting sleep, energy, appetite, and motivation.

- In contrast to dementia, which is slow and progressive, **delirium** is an acute disorder of cognition that is treatable and often reversible. It has a quicker onset, often on the scale of hours or days, and it may be accompanied by excessive drowsiness. The symptoms of delirium fluctuate and are often dominated by easy distractibility, inattention, and disorganized thinking.
- Some of the causes of delirium in elderly patients include infections or illness of almost any organ—pneumonia, urinary tract infections, or kidney disease, for example. Injuries, pain, or stress can all cause or exacerbate delirium, especially stays in the hospital or the intensive care unit.
- Many prescription or nonprescription drugs can contribute, as can low blood sugar or dehydration. Any big changes in life—moving, for example, or the loss of a loved one—can trigger or worsen delirium in elderly people at risk.
- Complicating all of this is that elderly patients with dementia can also have delirium—basically, an acute and treatable decline in function on top of a chronic, slow process. There is a lot of overlap in the causes and presentation, but it's important to try to think of these two processes separately because delirium, once diagnosed, can often be reversed. Depression can also coexist with both delirium and dementia, further muddying the diagnostic waters.
- Based on the first impression, it is possible that Isaac could have all three of these: dementia, delirium, and depression. His decline was more rapid than typical dementia, though sometimes the early signs of dementia could have been subtle and overlooked, especially if they were occurring right after his wife's death. Some degree of delirium could certainly be going on—and depression as well.

- The physical exam, overall, shows neurological problems across multiple areas of cognitive functioning. Isaac has memory problems, plus an inability to do simple arithmetic, and he can't seem to do ordinary motor tasks. There is at least some element of dementia.
- The neurological exam does not show any specific areas of motor weakness or sensory loss, what we would call focal neurological findings, making a specific, isolated brain lesion from a tumor or stroke unlikely. Whatever is going on, it must be a diffuse process throughout the cortex of the brain.

### **Taking Multiple Medications**

- Isaac's list of medications is not a huge list—for a 90-year-old man. He has a medicine for irritable bowel syndrome, an older medicine that's called an antispasmodic that slows gut contractions. He had been using that for years, and it was meant to be used as needed. Isaac's well-meaning son has been giving that medicine every day, thinking that it would improve his dad's appetite.
- Isaac is also taking an antidepressant; he's been on that for about a year or so. The dose, though, was increased a few months ago.
- In addition, Isaac went to the hospital for a urinary tract infection (UTI) four months ago in Florida. A UTI is definitely a cause of delirium in elderly patients, and older men are at risk for them because of urinary retention sometimes caused by an enlarged prostate. Because his doctors suspected some



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**Elderly people who seem to have dementia could instead be experiencing cognitive problems as a result of being on multiple medications.**

retention, he was prescribed a medication to prevent urinary retention, a common medication that's usually very well tolerated.

- However, all three of these medications have, in part, a similar pharmacological action. They all affect receptors of a neurotransmitter called acetylcholine, so they're all called anticholinergics. And there is an additive effect of using three anticholinergic medications with the same patient: You're much more likely to see anticholinergic side effects. Those can include a lot of different manifestations, including dry mouth, increased heart rate, and constipation, but—more importantly for Isaac—impaired concentration, memory, and attention.
- Isaac and his son are told to stop all three medications and make a follow-up appointment in one week. We also make arrangements for him to see a psychiatrist with expertise working with geriatric patients, and we contact a social worker to visit the home to help make sure that there are reasonable accommodations to prevent falls.
- One week later, Isaac is a different man. He walks in to the appointment, and he shakes your hand with strength and confidence. Tests of memory are still not at par with those of a young man; Isaac has some trouble repeating back reversed digits, but his **apraxia**, his inability to perform tasks, has disappeared.
- When asked about his wife, Isaac becomes tearful and sad. He talks about being lonely and about not wanting to be a burden to his son. So, there still may be an element of depression, and social support will still be essential.
- Isaac may have a mild degree of dementia as well. But addressing the medical cause of delirium—in this case, the medications he had been prescribed—was a huge step in improving Isaac's life and the life of his family.

## **Drug-Induced Cognitive Impairment**

- Drug-induced cognitive impairment occurs in about 12 percent of elderly patients with suspected dementia. Almost any class of medications can do this, including commonly used blood pressure medications, psychiatric medications, pain medicines (including ordinary nonsteroidal pain medicines like aspirin and ibuprofen), medications for allergy or GI conditions or diabetes, and even many over-the-counter medicines.
- Some of these medicines cause their mischief directly, as a side effect. Or, some medications affect the metabolism of other medications, so it might be the combination, or interactions between the medications, especially when combined with other health issues, that lead to cognitive problems.
- The more medications taken, the higher the quantity of different pills, the more likely any side effect will be, including cognitive problems. The risk of delirium on three medications is about three times the risk on one; if taking five medications, the risk increases ninefold.
- The exact risk depends on what medicines are taken in what combination and at what doses, and on other health factors, so it's impossible to know the exact risk for any one patient. But the risk is substantial, and it gets higher and higher as the number of medications increases.
- The single most important step to reduce the risk of drug-induced cognitive impairment is to minimize the number of medications taken. The minimal effective doses should always be used, and medicines should be taken for the shortest possible length of time. The highest risk medications, especially sedatives and combinations of anticholinergic medications, should be avoided when possible.
- It's also crucial that every prescribing physician have a complete and accurate list of all medications taken and doses, including all over-the-counter meds and supplements. Patients can help by

keeping a single, printed, up-to-date list or by bringing every single one of their medicine bottles to every single doctor's appointment.

- Caution is especially important when new medications are prescribed or doses changed, and of course, it's important that medicines be used correctly. If there is any concern about cognitive impairment, a family member or other responsible individual may be needed to take charge of medications to make sure they're used as intended.
- Medications certainly have their role. Medical problems like diabetes and arthritis need to be treated. Pain, especially, needs to be recognized and addressed, though that doesn't necessarily mean that pain has to be treated with medication.
- Drug withdrawal, too, can lead to delirium, so patients shouldn't stop taking medications on their own. Tapering down a long list of medications should be done under a doctor's supervision and advice and may need to be done in a stepwise, gradual fashion.

### Important Terms

**apraxia:** Inability to perform purposeful actions.

**delirium:** An acute deterioration in brain function, typically occurring from intoxication, infection, or other specific disorders.

**polypharmacy:** An informal term referring to a condition where many medications are taken at once, often leading to adverse reactions.

### Suggested Reading

Goldacre, *Bad Pharma*.

Mace, *The 26-Hour Day*.

## Questions to Consider

1. How can you tell the normal forgetfulness that accompanies aging from dementia?
2. Of all the tools that doctors use to evaluate patients, what is the most useful? Most cost effective? Most reliable?

## Glossary

**adhesion:** Surfaces stuck together, typically referring to organs and tissues within the abdomen.

**AED:** Automated external defibrillator.

**agonal:** Occurring just before death.

**ANA:** Antinuclear antibodies, a common blood test used in the evaluation of autoimmune and rheumatologic disease.

**anemia:** Low red blood cell count.

**angina:** Literally, “pain”—most often referring to angina pectoris, a kind of chest pain associated with decreased oxygen delivery to the heart muscle.

**anorexia:** Lack of appetite or disinterest in eating.

**antibodies:** Serum immunoglobulins that are part of the immune system.

**aphasia:** Inability to understand or express speech.

**apnea:** Cessation of breathing.

**apraxia:** Inability to perform purposeful actions.

**arrhythmia:** An irregularity in the heart rhythm. Although this term is used commonly, a more exact term that is preferred is “dysrhythmia.”

**arterial blood gas:** A blood test that measures pH and gases, including oxygen and carbon dioxide.

**arthralgia:** Joint pain without evidence of inflammation.



**arthritis:** Joint inflammation, typically manifested by stiffness and pain accompanied by swelling.

**ascites:** Abdominal swelling caused by accumulated fluid in the abdominal cavity.

**atelectasis:** Partially collapsed areas of lung, typically observed on a chest X-ray.

**autoclave:** A container that can be heated under pressure, typically used to sterilize medical equipment.

**bacteria:** A unicellular microorganism lacking a nucleus.

**bariatric surgery:** Surgery intended to assist weight loss.

**bilious vomiting:** Vomiting stained by bile, typically green or yellow; often an indication of abdominal obstruction.

**blanching:** To become white or colorless when squeezed or pressed.

**board certified:** Maintaining requirements by a medical specialty board, typically including passing examinations and fulfilling educational and practice requirements.

**bone scan:** A nuclear study that identifies areas of active bone turnover, typically from infection, trauma, or tumor.

**bruit:** A noise caused by turbulent flow in a blood vessel.

**candida:** A common species of yeast.

**cardiorespiratory monitor** (often abbreviated “CR monitor” or just “monitor”): An electronic device that measures and displays vital signs and often heart and breathing rhythms in real time.

**catarrh:** Excessive mucus in the nose or throat.

**catheter lab** (often abbreviated “cath lab”): Referring to an area of a hospital or clinic where procedures involving catheterization of blood vessels are undertaken. These include studies and interventions of the heart, brain, and other vasculature.

**cerebrovascular accident**: Stroke—brain damage caused by insufficient blood flow.

**chest tube**: More formally, thoracostomy tube—a tube used to drain air or fluid from the chest.

**chief complaint** (often abbreviated “CC”; “chief concern” is also used): A traditional part of a medical encounter that is typically recorded in the patient’s own words, expressing the main reason that the patient sought care.

**complete blood count (CBC)**: A common laboratory test that quantifies the different types of cells in the blood.

**concussion**: Brain trauma leading to symptoms of brain dysfunction.

**confluent**: Running together or atop one another, often referring to a rash characterized by individual spots that coalesce and touch each other, appearing as one larger area.

**congestive heart failure**: Insufficient output of blood from the heart, leading to fluid accumulation.

**computed tomography scan (CT scan)**: A study that uses a series of X-rays to construct two-dimensional images of internal structures.

**crackles** (also called “rales”): A physical exam finding of the lungs, crackles sound very much like the “snap, crackle, and pop” of milk poured over breakfast cereal.

**cranium**: The skull, or more specifically, the part of the skull that encloses the brain.

**C-reactive protein (CRP):** A blood protein that can be measured in the laboratory. An elevated CRP is an indication of inflammation.

**defibrillator:** A device that delivers a shock to the heart to restore a normal rhythm.

**delirium:** An acute deterioration in brain function, typically occurring from intoxication, infection, or other specific disorders.

**dementia:** A chronic disorder of brain functioning, most typically marked by memory problems in addition to other manifestations.

**deny:** In medical lingo, “deny” means that the patient says the symptom in question did not occur. It does not imply that the patient is being untruthful.

**differential diagnosis:** A list of candidate diagnoses to explain a medical problem.

**diplopia:** Double vision.

**dyschezia:** Painful defecation.

**edema:** Swelling, typically of an extremity.

**EKG:** Electrocardiogram—sometimes abbreviated ECG.

**EMR:** Electronic medical record—sometimes abbreviated EHR for “electronic health record.”

**EMT:** Emergency medical technician.

**encephalitis:** Inflammation of the brain, most typically caused by infection.

**encephalopathy:** Dysfunction of the brain from any cause.

**endocrine:** Relating to glands that secrete hormones into the blood.

**ENT:** A surgical specialty standing for “ear, nose, and throat”—sometimes referred to as otorhinolaryngology.

**epilepsy:** A neurologic disorder characterized by recurrent seizures.

**erythrocyte sedimentation rate** (often abbreviated “sed rate” or “ESR”): A blood test of inflammation.

**family practice:** A board-certified medical specialty that provides primary care to patients of all ages, often including obstetric care and minor surgery.

**fever:** An elevated body temperature.

**functional illness:** Symptoms that cannot be ascribed to any abnormality on an objective test, such as an X-ray or a blood test.

**general practitioner:** A physician who treats general conditions; this title does not require a residency or board certification.

**generic:** Referring to medications, “generic” means manufactured by a company that does not own the patent.

**genetic:** Relating to the genes, or the sequences of DNA encoded in cells that direct their functioning.

**glucosuria:** Glucose in the urine.

**grand rounds:** Medical education sessions typically presented to physicians and students, usually surrounding a single case presentation.

**HEENT:** “Head, ears, eyes, nose, and throat”—referring to these areas of the physical examination.

**hematochezia:** Visible blood in the stool.

**hematocrit:** A measure of the volume of blood that is taken up by red blood cells, expressed as a percentage.

**hemoglobin:** The molecule in red blood cells that binds oxygen. “Hemoglobin” often refers to a quantitative lab measurement of the concentration of this molecule in a blood sample.

**hernia:** A condition where an organ protrudes through the wall of the area surrounding it.

**history of present illness (HPI):** A chronologic account of a patient’s symptoms.

**homeostasis:** Physiologic equilibrium, as maintained by mechanisms that control vital processes.

**hormone:** A substance secreted into the blood that controls functions at a distant site—for example, insulin.

**hypoglycemia:** Low blood sugar concentration. Contrast with hyperglycemia (high blood sugar) or euglycemia (normal blood sugar.)

**hypoventilation:** Insufficient breathing, resulting specifically in increased carbon dioxide in the blood.

**idiopathic:** Of unknown cause.

**IgE:** Immunoglobulin E, a specific subtype of antibody that’s often associated with allergic disease.

**IgG:** Immunoglobulin G, the most common subtype of antibody circulating in blood.

**ileus:** A cessation of the normal movements of the gut wall.

**immune globulin:** Proteins that assist immunity, often called “antibodies.”

**incidentaloma:** An informal word referring to something found on a test or radiology study that is unrelated to the problem being investigated.

**inflammation:** A physiologic reaction to infection or stress that can include redness, swelling, pain, and warmth.

**intellectual disability (MR):** Impaired cognitive or intellectual functioning. Often used synonymously with or as a preferred term for “mental retardation.”

**intern:** A graduate of medical school training in the first year after graduation.

**internal medicine:** A medical specialty that concentrates on the diagnosis and management of nonsurgical problems in adults.

**internist:** A physician practicing internal medicine.

**intravenous (IV):** Within a vein.

**intubation:** Placing a tube within a hollow organ, most commonly referring to an endotracheal (breathing) tube placed in the trachea (airway).

**jaundice:** A yellow color to the eyes and skin caused by excessive bilirubin in the blood.

**laparoscopy:** A surgical procedure using optical instruments inserted through the abdominal wall to view the inside.

**laparotomy:** A surgical procedure including an incision into the abdominal cavity.

**lesion:** A region of an organ or tissue that has been damaged.

**liver function tests (LFTs):** More properly, “transaminases”—a collection of blood tests that indirectly measures the health of liver cells.

**lumbar puncture (LP):** Sometimes called a “spinal tap”—inserting a needle between the vertebrae to collect cerebrospinal fluid or instill medication.

**magnetic resonance imaging (MRI):** Using a strong magnetic field and radio waves to get detailed images of internal organs.

**metabolic:** Related to chemical processes that sustain life.

**metastatic:** Cancer appearing at a site distant to the original cancer, caused by migrating and then proliferating cells.

**murmur:** A noise heard over the chest with a stethoscope caused by turbulent blood flow through the heart.

**myositis:** Inflammation of muscle.

**narcotic:** A class of pain relievers derived from opium or morphine.

**nausea:** A feeling of queasiness, or that one is about to vomit.

**negative:** In medical use, “negative” means that the inquired symptom or finding is absent. It does not imply that this is good or bad.

**neuropathy:** Damage or malfunction of nerves.

**nystagmus:** A rapid, flicking movement of the eyes.

**opioid:** An opium-like compound, informally synonymous with “narcotic.”

**organic illness:** An illness that includes objective abnormalities on a blood test or radiologic study that correlates with symptoms.

**palpate:** To feel, as in part of the physical exam.

**paracentesis:** Inserting a needle into the abdominal cavity to obtain fluid.

**pathology:** Diseased tissue, or the collective features of a disease—or the branch of medicine that studies diseased tissues.

**peritonitis:** Inflammation in the lining of the abdomen.

**petechiae:** A physical finding of the skin, appearing as small broken blood vessels or red-purple, non-blanching spots.

**plasmapheresis:** A medical procedure that separates out the plasma from the whole blood and then filters out certain elements, typically proteins, before returning the blood to the body.

**platelets:** A kind of blood cell involved in clotting.

**polycythemia:** Excessively high red blood cell count.

**polypharmacy:** An informal term referring to a condition where many medications are taken at once, often leading to adverse reactions.

**positive:** In medical lingo, “positive” is used to denote a finding that is present. It does not imply whether this finding is good or bad.

**primary:** A problem or finding that isn’t caused by something else. For example, a primary headache isn’t caused by some other medical condition.

**pro re nata (PRN):** Literally, “as the thing is born” or “as the need arises”—refers to a medication that’s ordered to be given only as needed.

**pulse oximeter** (often abbreviated “pulse ox” or “POX”): A device that measures the pulse and oxygen saturation in blood.

**pulse rate:** A count of heartbeats per unit time, such as beats per minute.

**purpura:** Coalescing petechiae, or a large area of skin with bruising and broken blood vessels, leading to bleeding within or under the skin.

**red blood cells:** The cells in the blood that carry oxygen.

**referred pain:** Pain that is perceived in a different location than where the tissue damage is occurring.

**review of systems (ROS):** Part of the medical interview, with a series of questions organized by organ system to see if specific symptoms have been present.



**scintillation camera:** A camera that detects radiation, used in nuclear medicine studies.

**secondary:** A symptom or problem caused by some other medical problem. For example, a secondary headache may be caused by a sinus infection, concussion, or brain tumor.

**seizure:** A sudden disruption in the normal electrical activity of the brain, accompanied by altered consciousness, movements, or other neurologic manifestations.

**sepsis:** A whole-body inflammatory condition, triggered by serious infection.

**seroconversion:** When blood tests show that a person has been exposed to an infectious agent by demonstrating the presence of specific antibodies against that infection.

**shock:** A life-threatening state of insufficient blood flow to multiple organs.

**spirometry:** Tests of lung functioning.

**stenting:** Using a hollow tube to hold open a hollow organ, typically a blood vessel.

**stricture:** A narrowing of a hollow organ, such as the esophagus or a blood vessel.

**superinfection:** An infection that occurs on top of a first infection.

**syncope:** Synonymous with “faint”—a brief loss of consciousness caused by insufficient cerebral blood flow.

**syndrome:** A group of symptoms that occur together with a specific condition.

**tachycardia:** Fast heart rate.

**tenderness:** Pain that is increased with palpation.

**vertigo:** A spinning sensation, or feeling that one's environment is spinning around.

**vestibular:** Related to the sense of balance and position sense.

**virus:** A small infectious agent that does not contain its own cells or organelles.

**vital signs:** Collectively, clinical measurements of pulse rate, blood pressure, respiratory rate, and temperature.

**vitamin:** One of a group of compounds that are essential to be ingested in small quantities to maintain health and life.

**wheezing:** A physical exam finding of the lungs, heard best with a stethoscope. Wheezing sounds like air rushing through small tubes and is most typically heard in expiration.

**white blood cells:** The cells in the blood that are part of the immune system.

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## **Internet Resources**

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Medscape. <http://emedicine.medscape.com/>. Written for physicians but open to the public, this site includes monographs on almost any disease you'd want to learn about—the symptoms, the cause, the treatment.

MS Soft Serve. <http://mssoftserve.org/>. A unique and wonderful nonprofit site that provides great information for learning about multiple sclerosis at your own pace.

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Vestibular Disorders Association. <http://vestibular.org/>. Detailed and informative site about Ménière's disease and other vestibular disorders, with plenty of links to solid information and resources.

WebMD. <http://www.webmd.com/depression/>. For people who think they might be depressed, for their families, or for those recently diagnosed, this site offers solid information on resources and management.